

Juxtapositions of Density

A Study of the Relationship of Urban
Form to Abrupt Variations in Density

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ABSTRACT

The growth of high density developments outside city centers can create juxtapositions of high-rise and low-rise buildings, producing problems related to building height and bulk, differing scales, and solar and shadow effects. Understanding how these juxtapositions operate is vital in order to comprehend the problems which arise from them and to inform policies which seek to mitigate the issues they can create.

This research paper asks the question: How do juxtapositions of high-rise development and low-rise neighborhoods operate in terms of urban form, and how can empirical evidence of urban form be used to resolve the problems inherent with these situations?

This question will be answered by a comprehensive review of the regulatory responses to these conditions and empirical research through a review of case studies that feature these juxtapositions. The overview of regulations provides a greater understanding of the history of regulations pertaining to juxtapositions of density, and also provides an analysis of how regulations relate to these juxtapositions, urban form, and empirical evidence. The case studies explore several conditions from cities across the country, examining how differences in density operate within blocks, between blocks, and within changes in elevation. The case studies are analyzed according to subdivision, horizontal dimensions, vertical dimensions, orientation, and topography. The understanding of how the case studies work in terms of these characteristics of urban form will inform policy or additional research to mitigate the problems associated with abrupt changes in density.

INTRODUCTION

The growth of high density developments outside city centers can create juxtapositions of high density and low density. These juxtapositions can produce problems related to building height and bulk, differing scales, and shadow effects leading to tensions between developers and residents of adjacent neighborhoods. Understanding how these juxtapositions operate is vital in order to comprehend the problems which arise from them and to inform policies which seek to mitigate the issues they can produce.

Juxtapositions of high and low density are very common, occur across the country, and take many forms. Juxtapositions of density have become a common condition due to the growth of high density development outside of central business districts along high traffic corridors, mass transportation lines, waterfronts, and edge cities. The tremendous growth of Atlanta, GA starting in the 1970's produced high-rise developments along the Peachtree Street corridor from Midtown, through the Brookwood Area to Buckhead, adjacent to neighborhoods of single family homes dating from the 1920's. Similar growth patterns occurred on Wilshire Boulevard in Los Angeles, CA and along North Central Avenue in Phoenix, AZ, creating new conditions of differing densities. In Arlington, VA and Bethesda, MD, high intensity growth follows Metrorail transit stations built in the late 1970's and early 1980's. In Miami, FL, and Chicago, IL, high-rise residential towers position themselves between waterfronts and existing single family home neighborhoods. In edge cities formed with the expansive growth of Houston, TX--especially the Galleria area--corporate skyscrapers were constructed across the street and in the backyards of single family homes. While juxtapositions of density exist in a variety of forms, the underlying problems residing in each situation originate from issues of urban form.

In order to comprehend the underlying issues in urban form, it is important to understand that urban form is organized into a nested hierarchy of permanence: 1. The subdivision of land into public and private domains, 2. The public domain, and 3. The private domain. The subdivision of land involves the organization of territory into lots, blocks, and streets. The public domain includes streets, public landscapes, and public buildings, and the private domain includes private buildings and private landscapes (Dagenhart, 2011).

The combination of public and private domains organized into lots, blocks, and streets form urban structures that are classified as static, elastic, campus, or resilient tissues. Static tissues resist change as they are specifically designed to accommodate a specific type of structure, and subdivided lots are small and roughly the same size. Examples include suburban neighborhoods designed for single family homes. Elastic tissues evolve rapidly over time as they are not pre-planned, occur and depend on pre-existing paths and streets, and feature larger lots with a variation of sizes. Elastic tissues typically feature retail, commercial, and industrial uses and include strip shopping centers, fast food establishments, and gas stations. Campus tissues are large areas of land owned by single entities developed with multiple buildings organized with internal private streets which do not form boundaries between lots. Campus tissues comprise corporate campuses, hospitals, apartment complexes, universities, recreation areas, and other large campuses (Scheer, 2001).

In addition to static, elastic, and campus tissues, another form of tissue, resilient tissue, comprises the historic cores of cities. Similar to static tissues, resilient tissues are highly organized and stable in form, and typically feature smaller lots. Unlike static tissues, resilient tissues are not planned for a single building type and are instead organized into a grid of lots, blocks, and streets (Word, 2012). Resilient tissues are the most flexible of the four types of tissues as they allow incremental changes to buildings and lots over time, without fundamentally changing the underlying urban structure.

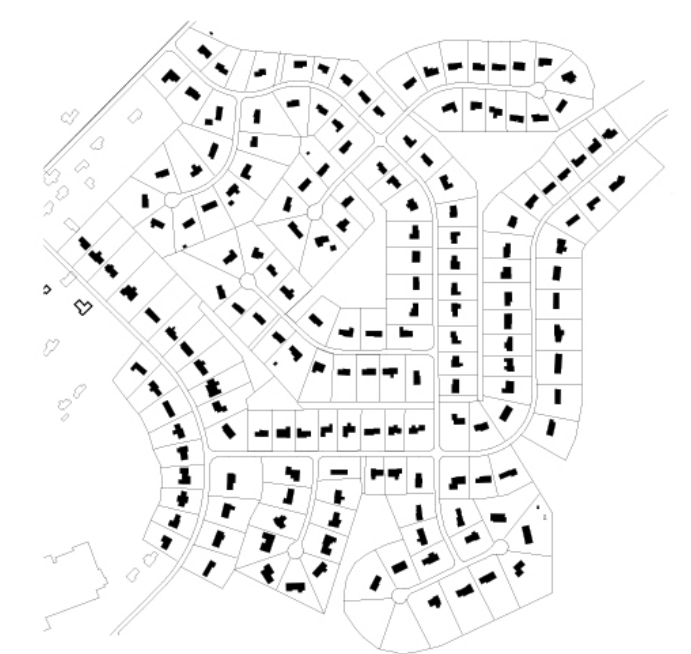
Problems and issues surrounding juxtapositions of density arise from the inherent qualities of static, elastic, and campus tissues and their proximities to one another. Adjacencies of static and elastic tissues can produce problems caused by the characteristics of lots and the ability (or disability) of tissues to change. Elastic tissues are comprised of large lots that accommodate the construction of larger projects and building footprints, while static tissues feature smaller lots that are designed for a single building type. Elastic tissues also change rapidly over time, while static tissues resist change. Similarly, campus tissues also comprise large



1.1 Buckhead: Juxtaposition of Densities (Source: Google Maps)



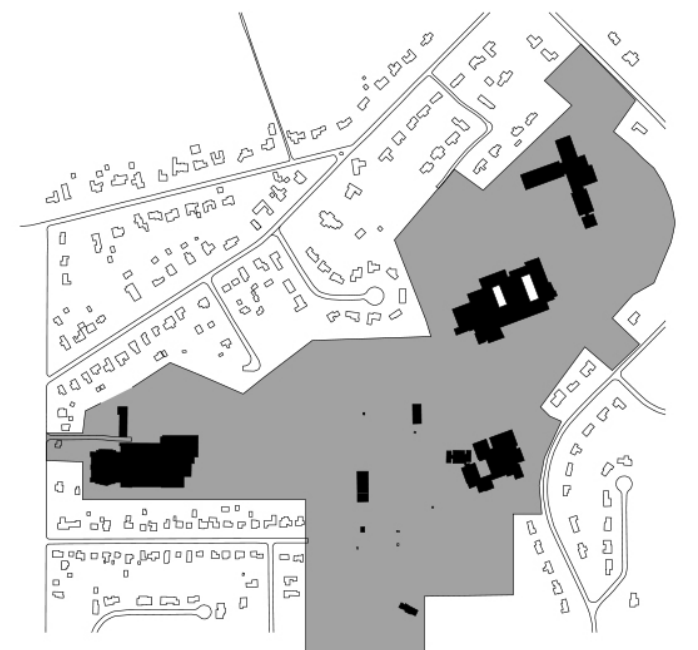
1.2 Phoenix: Juxtaposition of Densities (Source: Google Maps)



1.3 Static Tissue (Source: Scheer, 2001)



1.4 Elastic Tissue (Source: Scheer, 2001)



1.5 Campus Tissue (Source: Scheer, 2001)

areas that can allow very large projects and high-rise buildings to occur. As cities expand, problems surrounding juxtapositions of density occur as elastic and campus tissues change with the construction of large projects while static tissues resist change and preserve the existing building type.

When development occurs within resilient tissues, juxtapositions of density do not become an issue as the tissue inherently accommodates change. Resilient tissue allows the incremental transformation of the urban environment to occur, creating a complex urban fabric with multiple forms and scales. Juxtapositions of density are integrated as part of this urban fabric, instead of creating stark deviations from the surrounding urban context as seen in static, elastic, and campus tissues.

Historically, resilient tissue has illustrated how it can accommodate various scales of building types, originally with low-rise buildings, then early high-rises after the invention of the elevator, and even taller skyscrapers in the early twentieth century. The construction of taller buildings brought the perception of new problems from a lack of light and air reaching streets to issues of building massing. Regulations were seen as the solution to these new problems, especially in New York City with the development of the New York City Zoning Resolution of 1916. This zoning code became a model for other cities as they strived to reduce the issues concerning high-rise construction. The perception of problems influenced these regulations instead of utilizing the examination of the actual problems, research and understanding of the urban form, and the evidence to inform them.

This research paper asks the question: How do juxtapositions of high intensity development and low-rise neighborhoods operate in terms of urban form, and how can empirical evidence of urban form be used to resolve the problems inherent with these situations?

This question will be answered by a comprehensive review of the regulatory responses to these conditions and empirical research of case studies of these juxtapositions. The case studies explore several conditions from cities across the country, examining how differences in density operate within blocks, between blocks, and with topography. The case studies are analyzed concerning subdivision, horizontal dimensions, vertical dimensions, orientation, and topography. The understanding of how the case studies work in terms of these characteristics of urban form will inform policy or additional research to mitigate the problems associated with abrupt changes in density.



1.6 Wilshire Boulevard: Elastic & Static Tissues (Source: Google Maps)



1.7 Brookwood: Elastic & Static Tissues

1.8 Houston Galleria: Campus & Static Tissues (Source: Google Maps)



METHODOLOGY

This research paper examines juxtapositions of density and their relationship to urban form through two main sections: 1. Overview of Regulations and 2. The Case Studies. The overview of regulations provides a greater understanding of the history of regulations pertaining to juxtapositions of density, and also provides an analysis of how regulations relate to these juxtapositions, urban form, and empirical evidence. The case studies examine fifteen different examples of juxtapositions of density and how they operate within urban form through dimensions, subdivision, topography, and several other criteria.

Overview of Regulations

This section examines the different regulatory responses to juxtapositions of density with an emphasis on regulatory strategies employed in Atlanta, New York City, Vancouver, and San Francisco, although it cites examples from several other cities. Each regulatory strategy seeks to influence the scale, massing, or form of buildings in order to limit their size and shape to address issues related to juxtapositions of density. These strategies include the New York City Zoning Resolution of 1916, height maps and height controls, setbacks, transitional height planes, regulations of building form including the Brookwood Alliance Plan, regulations concerning the relationship of building height to the street, strategies related to solar orientation, regulations related to public space such as the New York City Zoning Resolution of 1961, and regulations related to topography such as the San Francisco Urban Design Plan of 1971. Each section highlighting a regulatory strategy also includes a brief analysis illustrating how they affect juxtapositions of density or their effects in relation to urban form. All of these types of strategies present a broad range of regulatory practices that address dimensions in plan, dimensions in section, solar orientation, and topography, which are also analyzed within each case study.

Case Studies

The fifteen case studies were chosen from eight different cities and are classified into three sections based on how the juxtapositions operate within the urban form. 1. The juxtapositions of density within blocks illustrate examples where abrupt changes of building height and density occur within the middle of the block. 2. The juxtapositions between blocks show examples where abrupt changes in building height and density occur between two different blocks. 3. The juxtapositions of density with topography show examples where abrupt changes in building height and density occur with major changes in topography. Additionally, for each section, a case study which exhibits poor urban conditions is also shown. The case studies for each section are as follows:

Juxtapositions of Density Within Blocks:

- New York: Avenues on the Upper East Side
- New York: 86th Street on the Upper West Side
- New York: Frontage on Central Park on the Upper West Side
- Chicago: Uptown (Frontage on Lake Michigan lakefront)
- Philadelphia: Rittenhouse Square (Frontage on greenspace)
- Atlanta: Brookwood (Shows poor urban conditions)

Juxtapositions of Density Between Blocks:

- New York: Upper West Side on Riverside Drive
- Chicago: State Street south of downtown
- Philadelphia: Rittenhouse Square
- Houston: Galleria/Marathon Oil Building (Shows poor urban conditions)

Juxtapositions of Density with Topography:

Seattle: Vine Street

San Francisco: Pacific Heights, Laguna Street

San Francisco: Pacific Heights, Franklin Street

Atlanta: 16th Street and Ansley Park

Los Angeles: Wilshire Boulevard (Shows poor urban conditions)

These case studies were chosen to reveal examples where juxtapositions of density are integrated into the urban fabric, usually within resilient tissues. Case studies were typically identified in close proximity to the center of cities as well as having a gridded block structure. They were also chosen to fit within the three categories of juxtapositions within blocks, between blocks, and with topography. Case studies showing poor urban conditions were identified in areas with static, elastic, and campus tissues, typically outside of city centers.

The analysis of each case study will reveal empirical evidence of how juxtapositions of density operate. This operation is shown through the analysis of subdivision, dimensions in plan, dimensions in section, solar orientation, and topography. Each case study is also shown through plan, section, and a table of dimensions. The analysis relies on these drawings, tables, and other diagrams, instead of text, to show how juxtapositions work with urban frameworks. The dimensions of each case study provide the foundation for the analysis, conclusions, and recommendations to improve regulations related to juxtapositions of density. Finally, the analysis of the case studies is classified into six different conclusions that illustrate the different ways in which they operate.

OVERVIEW OF REGULATIONS

Since the advent of high-rise construction, many regulatory measures have been proposed or enacted to control the height and bulk of tall buildings. These regulatory ideas and policies are typically conceptual in nature, aimed at primarily influencing the size and shape of development. The regulations have taken a variety of forms, with objectives ranging from increasing light and air on the street, to creating public space, to pushing buildings away from other buildings and zoning districts. While these regulations are not created specifically to solve problems associated with juxtapositions of densities, they illustrate the effort to solve the problems through conceptual solutions, not with empirical evidence examining urban form and existing conditions.

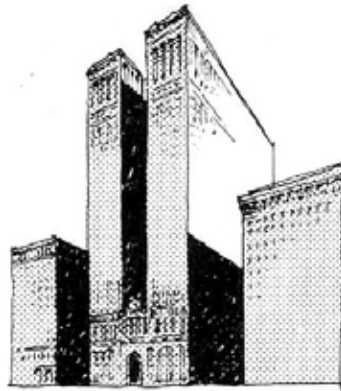
New York Zoning Resolution of 1916

The New York City Zoning Resolution of 1916 responded to the tall and massive buildings built in Manhattan in the early twentieth century and the concerns about their effect they had on reduced levels of light and air on the street. The zoning resolution established five height districts which restricted building height for the entirety of the lot area to heights related to the width of the street and the regulations for each height district. Buildings could be constructed higher than this limitation based on how far the building stepped back from the street, and there was not any height restriction for 25% of the lot area (New York City Zoning Resolution, 1916). These regulations produced the “wedding cake” style building prominent in New York until the 1960’s. The resolution accommodated the construction of buildings up to the lots lines, accommodating the street wall and urban environment that preexisted the resolution. Furthermore, the building bulk setbacks and exception to the height limit for 25% of the lot area allowed slender towers to be constructed. The slender towers were the realization of the goal to increase the amount of light and air on the street.

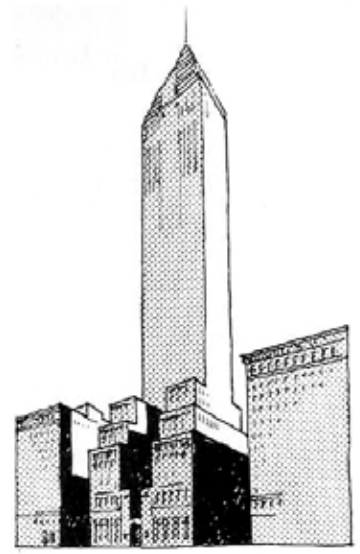
The subdivision and urban form of New York also informed the potential massing of buildings through long and narrow blocks. Hugh Ferriss produced several studies examining the massing of buildings and wrote, “The limitation in mass had...the effect of permitting more light and air into the streets as well as into the buildings themselves.” (72) His illustrations depict the massing of buildings according to the 1916 zoning resolution that utilize a full 200’ by 600’ New York City block as the building footprint. While they show the influence of the zoning resolution on the bulk of the building, they also exhibit the influence block structure had on the massing of buildings. With narrow blocks, even buildings that utilize the entirety of a block still remain slender in one direction with the spacing of streets between them. While the drawings of block-wide building footprints show this characteristic, they are not realistic as common or typical building forms. The expansion of Hugh Ferriss’s study to the lot level would have revealed even more interesting facets of the effect of urban form on building scale and massing.

The zoning resolution’s use of street width as a determinant for building height allowed the building forms and scales to closely relate to the urban form. Properties that front wide avenues had the ability to build higher, reflecting the high traffic nature of the avenues and the higher real estate value of the properties that front them. Properties fronting narrower streets had greater height restrictions, producing shorter buildings in the interior of the blocks that are more in character to the lower traffic volume and smaller scale of narrow streets. The use of street width to influence building height and massing, along with the variation of street width across New York created a complex urban fabric that reflected the underlying urban form.

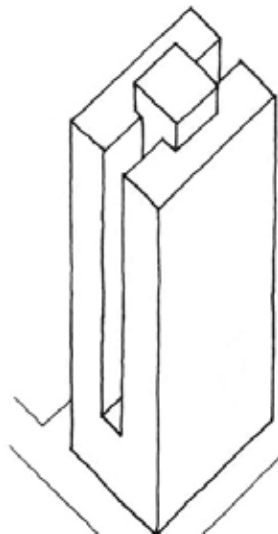
At the parcel scale, the zoning resolution only restricted height on the sides of lots which face the street. For example, buildings on the corner of a block only set back on the edges of the streets, and the edge of the building on the interior of the block can rise straight up to the height of the building without any setbacks. This aspect of the resolution illustrates that the goal of the regulations was to increase light and air along streets and sidewalks, without consideration of light and air on adjacent properties. This allowed juxtapositions of density within blocks with no buffer or restrictions between properties or buildings, creating a greater variation of scales and buildings forms as well as a more complex urban environment.



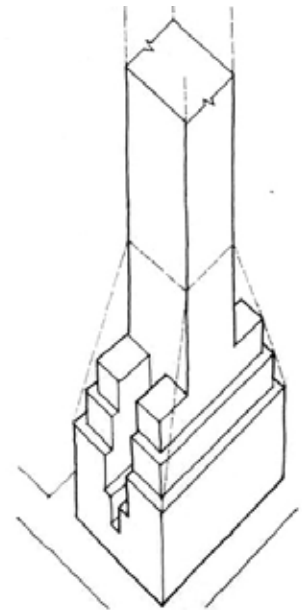
3.1 Pre-1916 Equitable Building



3.2 Post-1916 Zoning Resolution



3.3 Pre-1916 Zoning Resolution



3.4 1916 Resolution Building Envelope

3.1-3.4 Before and After: 1916 New York Zoning Resolution
Source: Barnett, 1982



3.5 1916 Restrictions Along Streets, Not Interior of Blocks
(Source: Bing Maps)

The Zoning Resolution of 1916 utilized the urban form of New York through the creation of slender buildings influenced by narrow blocks, the reflection of the character of the street through the relationship of building height to street width, and the continual evolution of a complex urban fabric at a parcel scale with small lots. While the Zoning Resolution of 1916 later served as a model for similar types of building bulk and height regulations throughout the United States, the regulations were dependent on a specific urban form that every other city lacks. This disconnect between urban form and regulations illustrates the need to utilize the research and study of empirical evidence to inform regulation.

Height Maps and Height Controls

Height maps were also a common method to regulate the height of buildings. The Atlanta Zoning Ordinance of 1929 established a height map which consisted of three districts, H1, which restricted buildings to 50 feet, H2, which restricted buildings to 100 feet, and H3, which restricted buildings to 325 feet. These regulations have no relationship to urban form and lack the support of empirical evidence as the reasoning for the dimensions of 50, 100, and 325 feet to control height.

Vancouver, BC also employs height maps to control building height to preserve the views of mountains, the downtown skyline, and the ocean. The height maps preserve these views through the establishment of 27 view corridors and the limitation of height within them (www.vancouver.ca). These height controls present a unique method of regulation that relates to the context on a macro scale, but not on a micro scale. The view corridors are calculated from view cones (viewsheds from a specific area) and show an effort towards the utilization of empirical evidence through the use of calculations involving the existing urban conditions. While these regulations do not relate with the existing urban form, Vancouver has other regulations of building height and form that relate more to urban form that will be discussed later.

Setbacks

Setbacks illustrate another form of regulatory response to high-rise construction. A simple approach, setbacks work primarily to put distance between high and low buildings either through front, rear, or side setbacks. Eisner states that, "The ground space reserved by these provisions has never been sufficient for its purpose: the setback distances and lot coverage restrictions have rather been token grants of space sacrificed after the land had acquired great value (The Urban Pattern). The effect of these regulations is minimal as the small increase in space between buildings does not have much effect on the issues and environment surrounding juxtapositions of density. The form and operation of juxtapositions of density have a much greater influence than setback regulations.

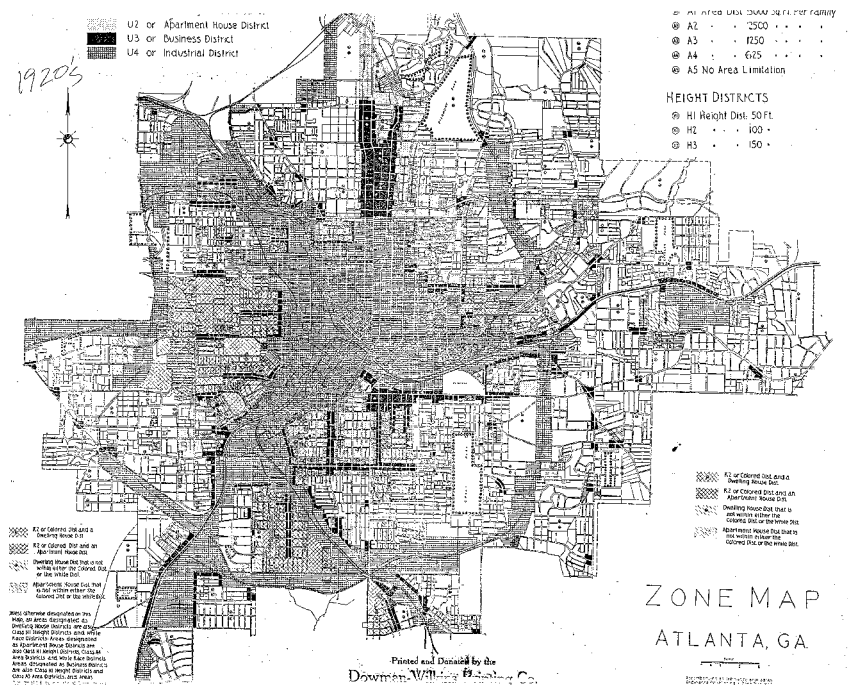
Setbacks are not grounded in existing conditions or urban form. Zoning regulations using setbacks bring development inward and away from property boundaries with the theory that the rights of the adjoining property owners represent the public interest most in need of protection. These setback and bulk controls do not take account of topography, orientation, or the nature of existing buildings in the area" (Barnett, 66). Setbacks attempt to fix issues of juxtapositions of density through the creation of a pseudo-public space and arbitrary spacing of buildings. They fail to relate to urban form, and in practice, they can go completely against the operation of the existing urban structure. While setbacks can be very harmful for the pedestrian realm, urban fabric, and street edge, the setback of building masses or towers above a street level base can present an opportunity to accommodate juxtapositions of density in a way that still conforms and utilizes the existing urban form.

Transitional Height Planes

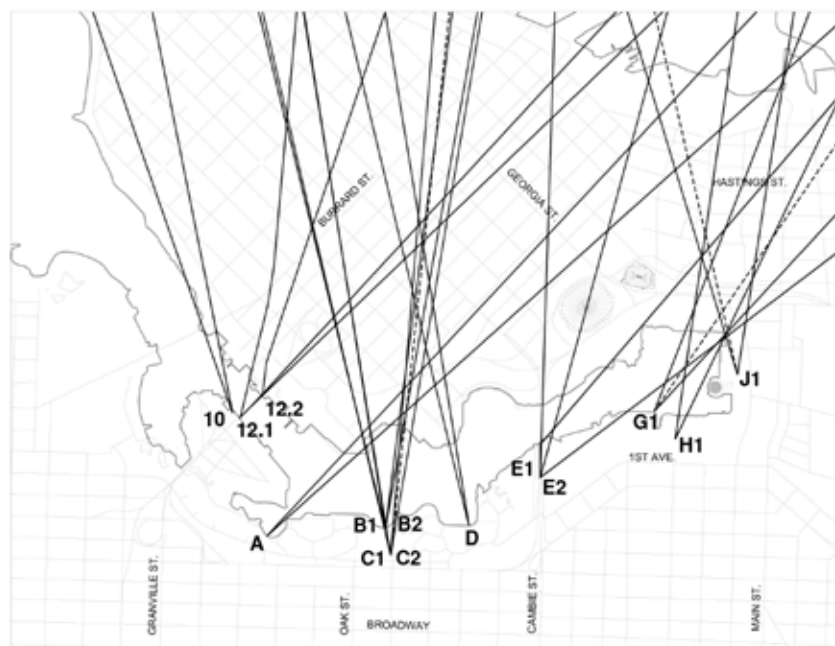
Transitional Height Planes regulate height in relation to adjacent zoning districts, but they remain arbitrary and conceptual. They seek to pull the main mass of buildings away from adjacent zones by limiting a building's height within a certain envelope, but these limitations have no relation to urban form or site conditions such as street width or lot size, only a specified angle. For example, the City of Atlanta Zoning ordinance for the C2 zone currently states:

"Where this district adjoins a district in the R-1 through R-G classification without an intervening street, height within the district shall be limited as follows: No portion of any structure shall protrude through a height-limit plane beginning 35 feet above the buildable area boundary nearest

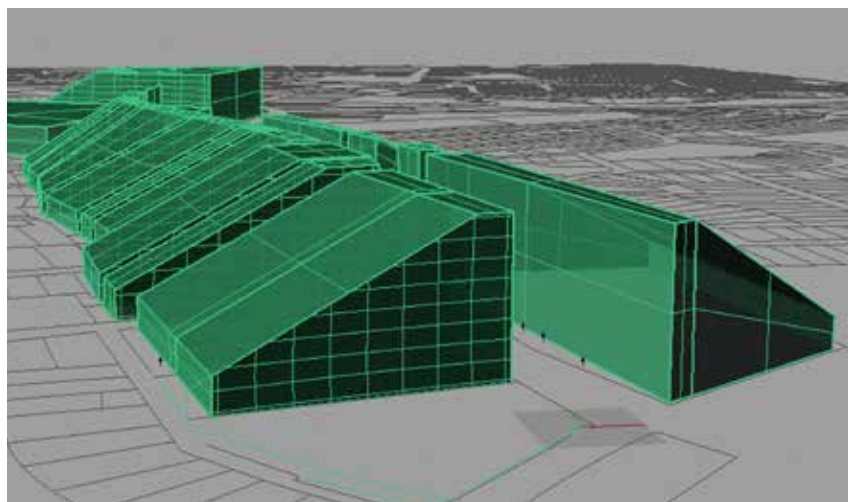
3.6 1929 Atlanta Zoning Map Showing Height Districts
Source: City of Atlanta



3.7 View Corridors of Vancouver
Source: City of Vancouver View Protection Guidelines, 2011



3.8 Building Envelope of Transitional Height Plane in Atlanta
Source: Brookwood Alliance Plan, 2010



to the common district boundary and extending inward over this district at an angle of 45 degrees.”

This zoning language raises several questions: What metrics are used to determine that the angle of the height plane shall be 45 degrees? What empirical evidence shows that the height limit plane should start at 35 feet? While these questions cannot be answered within the context of the zoning ordinance, it is clear that this regulation does not consider the urban form of Atlanta or the study and evidence from similar situations to inform the regulation. Without this connection to urban form and empirical evidence from real life examples, transitional height planes can easily have the opposite effect of what that are enacted to do. Instead of allowing more light and air to move between buildings to adjacent districts, they can have the opposite effect, producing large buildings with little space in between as they do not control the right dimensions, conditions, or forms.

Building Bulk Regulations: Brookwood Alliance Plan

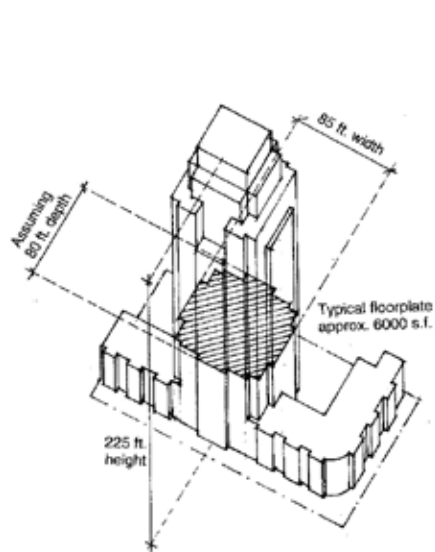
Other proposed regulations, such as those in the Brookwood Alliance Plan and in the City of Vancouver offer an alternative to transitional height planes to mitigate the issues of juxtapositions of density through the proposal of narrow towers on a low-rise base. The regulations proposed within the Brookwood Alliance Plan prevent high-rise development in close proximity to single family homes within the “Single Family Protection Zone,” and restrict the construction of high-rise towers toward the street into two “development zones.” The plan regulates the form of the towers in the development zones to be narrow in response to the orientation and geometry of the lots in an effort to allow light and air to pass through to the adjacent neighborhoods. While urban form influences this aspect of the plan, other characteristics of the plan fail to have a basis in urban form or existing conditions. The dimension that defines the buffer for the “Single Family Protection Zone” is not derived from existing conditions or research, illustrating a conceptual, but not fully thought out solution to the issues.

The City of Vancouver’s design guidelines and policies also advocate for creation of slender towers, although the goal of the policies in Vancouver is to maximize views between proposed projects and existing and future developments on surrounding sites. The Downtown South Guidelines state, “This can be achieved with slim, compact towers that maximize views between buildings rather than wide towers that block views, and the appropriate height, siting and spacing of towers in relation to other existing and future projects” (2.4.2.a). The Guidelines also specify that new developments should construct continuous street frontage with a height of at least 30 feet (4.1.1.a.i). While these regulations will help mitigate issues surrounding juxtapositions of density, especially with the goals of preserving views, they are not supported with empirical evidence or close relationships to the underlying urban form. The 30 foot height requirement is arbitrary and has no relationship to street width. Although it is only a minimum requirement (The maximum is 100 feet for the building base along the street), it cannot react to the changes in street width, character, and traffic volume in the same way that other regulations can, such as the New York 1916 Zoning Resolution. While these regulations could be improved, they represent one of the best solutions today to address the problems of juxtapositions of density.

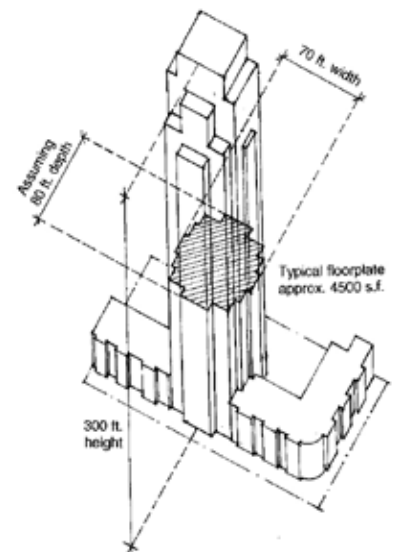
Relation to the Street

Urban form influences some regulations, especially those with direct relation with the street. In Paris, the width of the street directly informs the height of buildings and directs the bulk of building masses to the street. Wider streets produce taller buildings, which establishes a clear relationship between the horizontal dimensions of the public space and the vertical dimensions of private development, which produces scales appropriate for each type of street.

The LEED for Neighborhood Development Rating (LEED-ND) also relates to street width, requiring 15% of buildings to have a minimum height of one-third the width of the street. This can produce consistent urban conditions in relation to the street, but fail to produce a textured urbanism that responds to the flexibility of the urban form. These regulations can prevent the flexible qualities of urbanism that many desire and point to as important examples and case studies. The regulations within LEED-ND could be improved through the use of empirical evidence to influence the dimensions used within the regulations. Utilizing the New York Zoning Resolution of 1916 as precedent presents a good start. The combination of its regulations, along with variations in street width produced a textured urban fabric that mitigates issues of juxtapositions of density and responds to urban form. Regulations related to street width can be tailored to the existing dimensions and urban form of city in which the regulations are being written.



3.9 Lower, Wider Tower Configuration



3.10 Higher, Slimmer Tower Configuration

3.9, 3.10 Slender Towers on Bases in Vancouver
Source: Vancouver Downtown South Guidelines, 2004



3.11 Slender Towers on Bases in Vancouver
Source: Citytank.org



3.12 Existing Building Envelope in Brookwood, Atlanta
Source: Brookwood Alliance Plan, 2010



3.13 Proposed Building Envelope in Brookwood, Atlanta
Source: Brookwood Alliance Plan, 2010

Solar Orientation

Other concepts attempt to control the height of development through solar orientation. Walter Gropius's solar diagrams illustrate that solar orientation is the sole organizing principle for building, with solar angles dictating the height and orientation of single loaded high-rises. The diagrams also demonstrate that taller buildings produce increased levels of greenspace between towers which also creates poor urban conditions where fronts face backs. Siemensstadt, Berlin shows these conditions with disjointed frontages and privatized open spaces, illustrating that orientation cannot form the primary basis for the regulation of height, but that it should just exist as one of many informants for the mitigation of issues surrounding juxtapositions of density.

Public Space: 1961 New York City Zoning

In 1961, New York City overhauled its zoning code to provide incentives for public spaces in return for additional density in response to perceptions that the 1916 zoning code limited adequate densities. This new zoning code disregarded urban form in favor of an urban strategy dominated by development and open space, producing poor urban conditions within New York City. Barnett states, "Zoning regulations that encourage plazas have had the effect of belatedly imposing a fragmentary version of 1920s modernism on cities, creating towers that stand in their individual pools of public space, surrounded by the party walls of earlier structures that were planned to face the street. Shopping frontages are interrupted and open spaces appear at random unrelated to topography, sunlight, or the design of the plaza across the way" (73). New York's incentive zoning produced inactive public spaces that destroyed the urban street wall and created odd relationships with surrounding development. The failure of this incentive zoning is due to a lack of empirical research and basis of the regulations with the existing urban structure, and its failure is evidenced by the rewriting of the zoning code shortly thereafter.

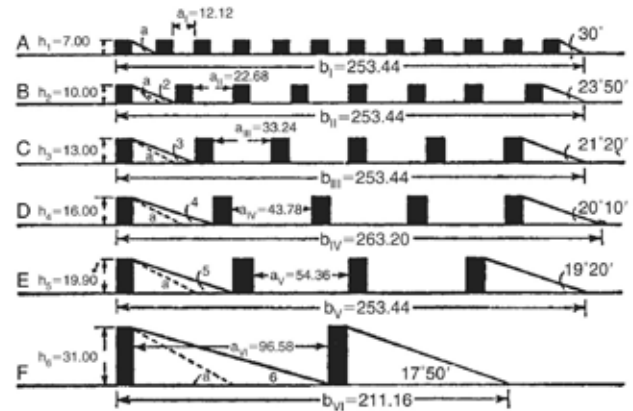
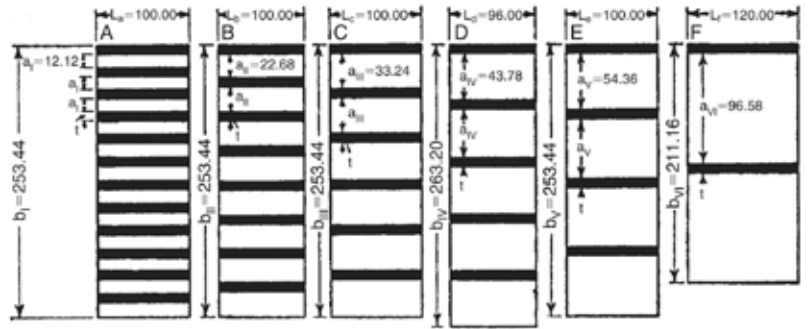
Topography: The San Francisco Urban Design Plan of 1971

The San Francisco Urban Design Plan of 1971 sought to control the bulk of buildings, instead of solely the height. Barnett states that, "The relationship of a building's size and shape to its visibility in the cityscape, to important natural features and to existing development determines whether it will have a pleasing or a disruptive effect on the image and character of the city. A: Tall, slender buildings near the crown of a hill emphasize the form of the hill and preserve views. B. Extremely massive buildings on or near hills can overwhelm the natural land forms, block views, and generally disrupt the character of the city" (131). The new regulations proposed new ways of measuring the bulk of buildings either through a maximum plan dimension (longest wall) or a maximum diagonal plan dimension which could relate the bulk of new buildings to the scale of the existing development. While these proposals could work in practice, they contain no relation to orientation, an important aspect if views are a main influence in the regulations. The plan also provides no basis for the allowable bulk dimensions in relation to urban form, utilizing arbitrary numbers instead.

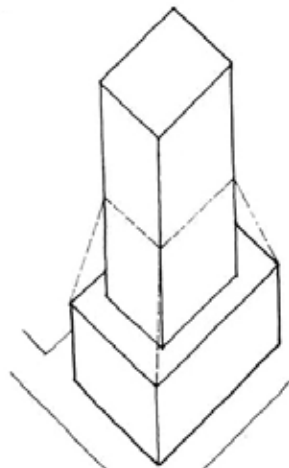
Overview

Each regulation, idea, or concept aimed at controlling density has produced various effects. Some have experienced successful results, but many have shortcomings that are inherent in the way that the regulations were formulated. Some regulations produce urban conditions that operate poorly, such as inactive public spaces with New York's 1961 incentive zoning, setbacks based on arbitrary dimensions, or transitional height planes that can block light and air to adjacent neighborhoods. Other regulations control development too much, preventing the diverse and textured urbanism that many desire. The reliance on arbitrary dimensions and metrics also produces effects that are not grounded through urban form.

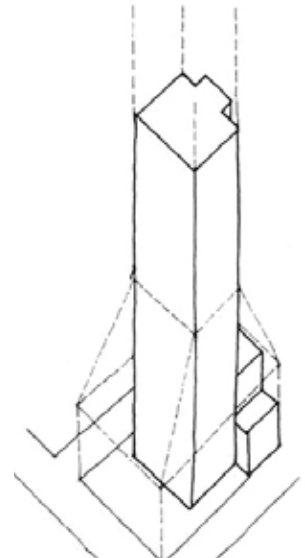
A new approach is needed to comprehend how juxtapositions of density operate. In the next section, this research paper will utilize empirical evidence through several case studies to analyze how juxtapositions of density work through several metrics including, horizontal dimensions, vertical dimensions, subdivision, orientation, and topography. The case studies are broken up into three categories, with juxtapositions of different densities occurring mid-block, between blocks, and in relation to topography. Both good examples and poor examples are studied, analyzing the mechanisms that lead to their success or failure. With this empirical analysis, an understanding of the mechanisms of juxtaposition of density can inform changes in policy, ideas, or bring to light new directions for additional research.



3.14 Gropius Sunlight Diagrams
Source: representation3.blogspot.com



3.15 Tower on a Base



3.15 Tower on a Plaza

3.15, 3.16 Building Envelopes 1961 New York Zoning
Source: Barnett, 1982



3.17 San Francisco Height Regulations Relate to Topography
Source: Barnett, 1982



CASE STUDIES

JUXTAPOSITION OF DENSITY WITHIN BLOCKS: New York: Avenues

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	50'
Lot Area:	5000sf
High-Rise Building:	
Lot Depth:	125'
Lot Width:	100'
Lot Area:	12500sf
Block Size:	200'x420'-600'
Right of Way Width:	55' (St) 75'-125' (Ave)

Dimensions (Section)

Low-Rise Building:	
Height:	60'
Depth:	88'
Width:	50'
High-Rise:	
Height:	230'
Base Depth:	85'
Base Width:	120'
Tower Depth:	120'
Tower Width :	85'
Building Height Difference:	170'
Building Height Ratio:	3.83
High Bldg Height/Street Width Ratio:	1.84
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	96%
Low-Rise Building Depth/Lot Depth:	88%
High-Rise Tower Width/Lot Width:	85%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	82%
Space Between Buildings:	25'

Orientation

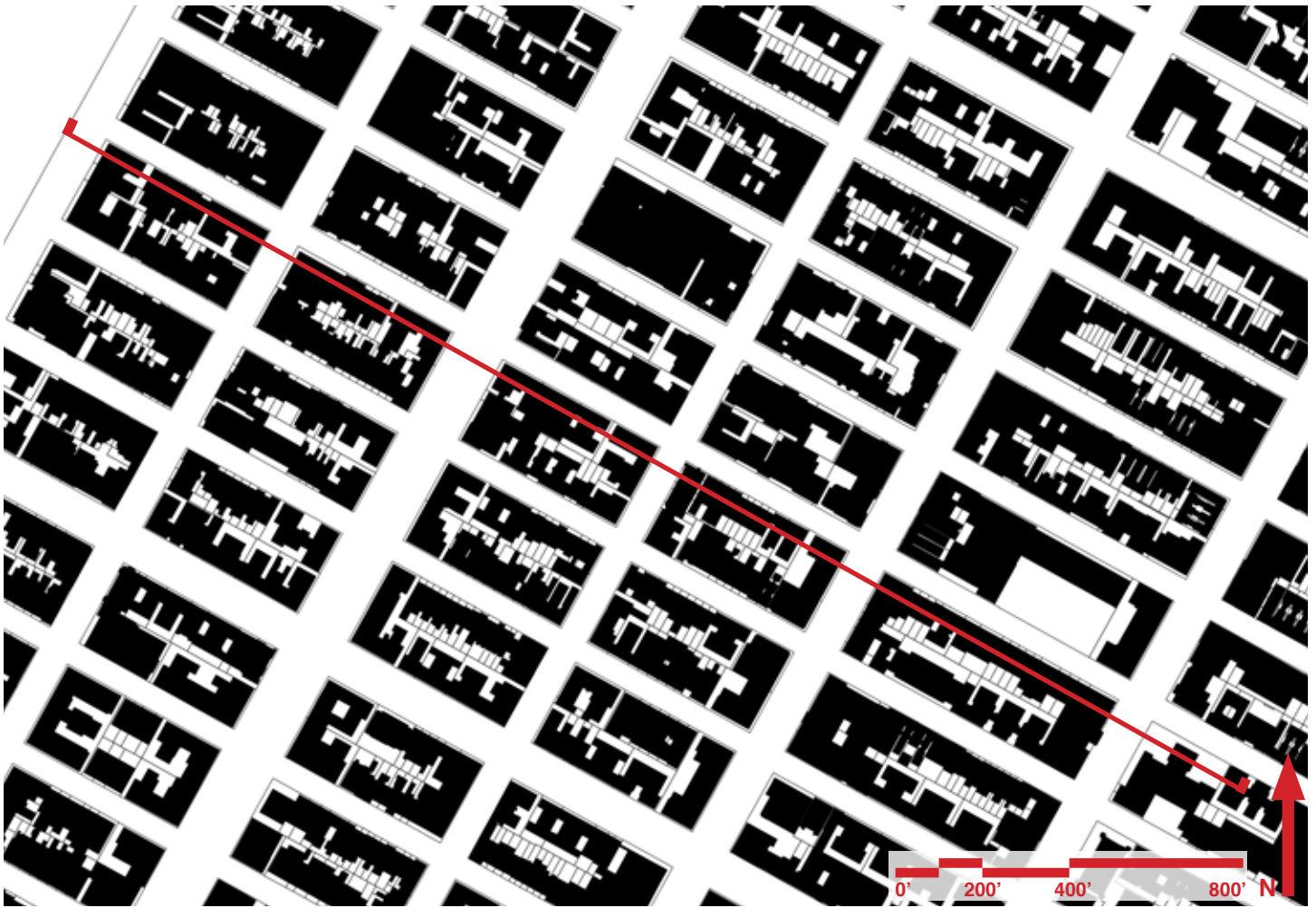
Orientation of Tower to Low Building:	East/West
Average Shadow Hours for Low Building:	0-6

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

The avenues on the Upper East Side of Manhattan illustrate a response to the New York Zoning Resolution of 1916, urban form, and real estate values. Buildings along the avenues feature much higher building heights than buildings on the interior of the blocks. The wide width of the avenues and narrow dimensions of blocks help space out taller buildings and bring light and air into the interiors of the blocks. The small lots, different lot frontages, variations in street widths, and Zoning Resolution of 1916 help to create a complex urban fabric that helps to address the issues of juxtapositions of density.





JUXTAPOSITION OF DENSITY WITHIN BLOCKS: New York: 86th Street

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	17'
Lot Area:	1700sf
High-Rise Building:	
Lot Depth:	100'
Lot Width:	80'
Lot Area:	8000sf
Block Size:	200'x800'
Right of Way Width:	82'

Dimensions (Section)

Low-Rise Building:	
Height:	55'
Depth:	70'
Width:	17'
High-Rise:	
Height:	165'
Base Depth:	85'
Base Width:	80'
Tower Depth:	85'
Tower Width :	40'
Building Height Difference:	110'
Building Height Ratio:	3
High Bldg Height/Street Width Ratio:	1.64
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	85%
Low-Rise Building Depth/Lot Depth:	71%
High-Rise Tower Width/Lot Width:	50%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	43%
Space Between Buildings:	34'

Orientation

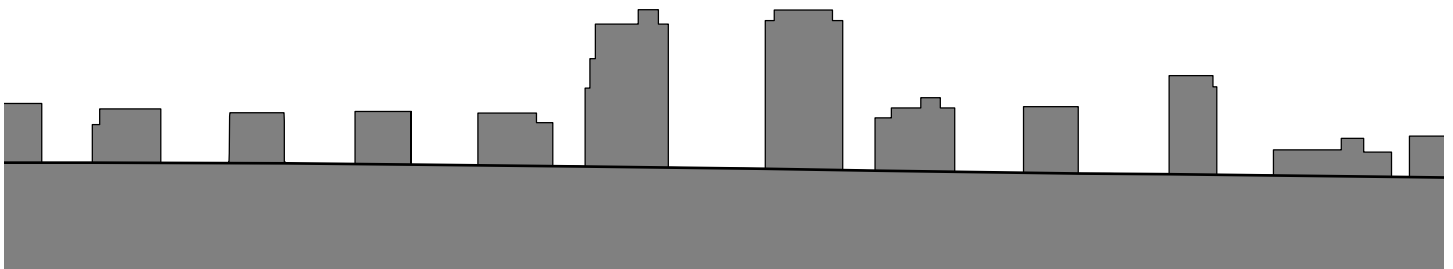
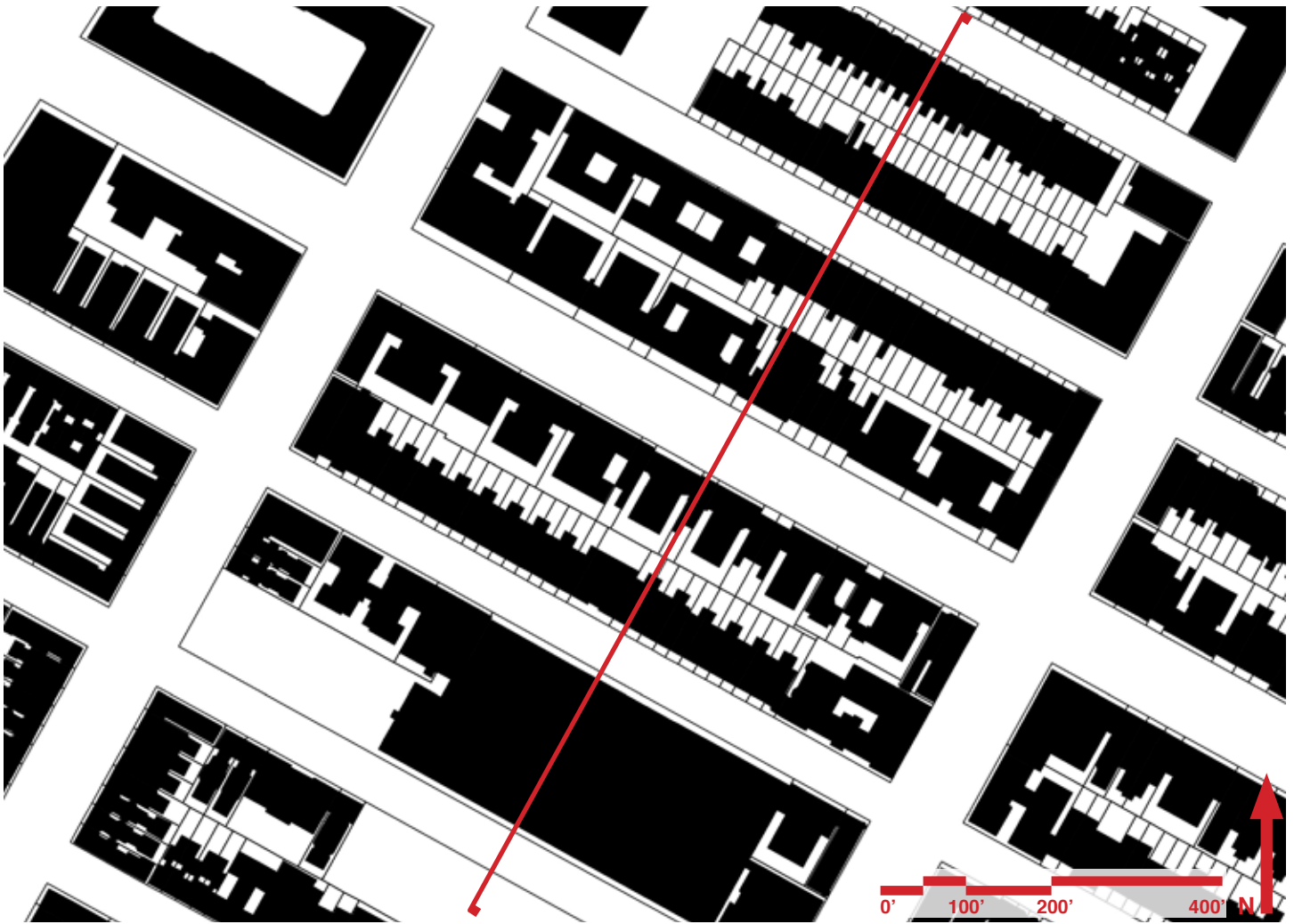
Orientation of Tower to Low Building:	North/South
Average Shadow Hours for Low Building:	0-3

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

86th Street on the Upper East Side functions similarly to the avenues, as it is a high traffic street that provides an important connection across Central Park. This high traffic volume produced higher building heights along 86th street and lower building heights on the sides of the block which face 85th and 87th streets, producing a juxtaposition of density mid-block. This juxtaposition operates well because lots face opposite directions, and narrow lots tend to produce taller buildings with slender widths, increasing light and air to adjacent properties.





JUXTAPOSITION OF DENSITY WITHIN BLOCKS:

New York: Upper West Side and Central Park

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	Yes

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	50'
Lot Area:	5000sf
High-Rise Building:	
Lot Depth:	125'
Lot Width:	80'
Lot Area:	10000sf
Block Size:	200'x800'
Right of Way Width:	55'

Dimensions (Section)

Low-Rise Building:	
Height:	60'
Depth:	65'
Width:	50'
High-Rise:	
Height:	400'
Base Depth:	130'
Base Width:	200'
Tower Depth:	70'
Tower Width :	50'
Building Height Difference:	340'
Building Height Ratio:	6.45
High Bldg Height/Street Width Ratio:	8
Transitional Height Angle:	60°
High-Rise Tower Depth/Lot Depth:	56%
Low-Rise Building Depth/Lot Depth:	65%
High-Rise Tower Width/Lot Width:	63%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	35%
Space Between Buildings:	10'

Orientation

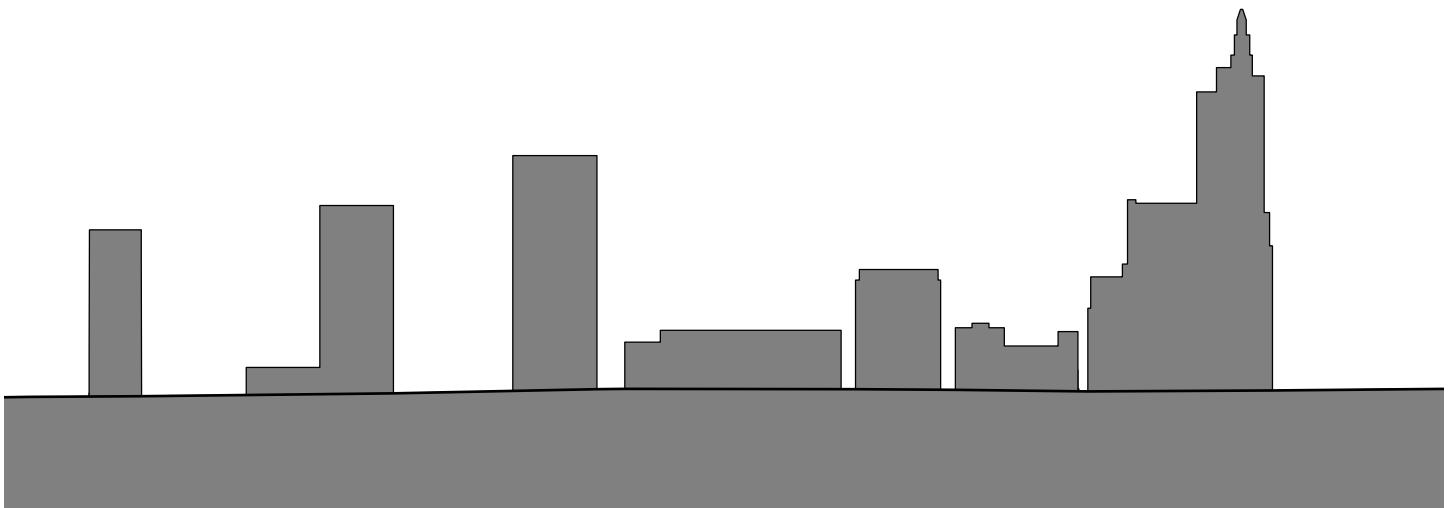
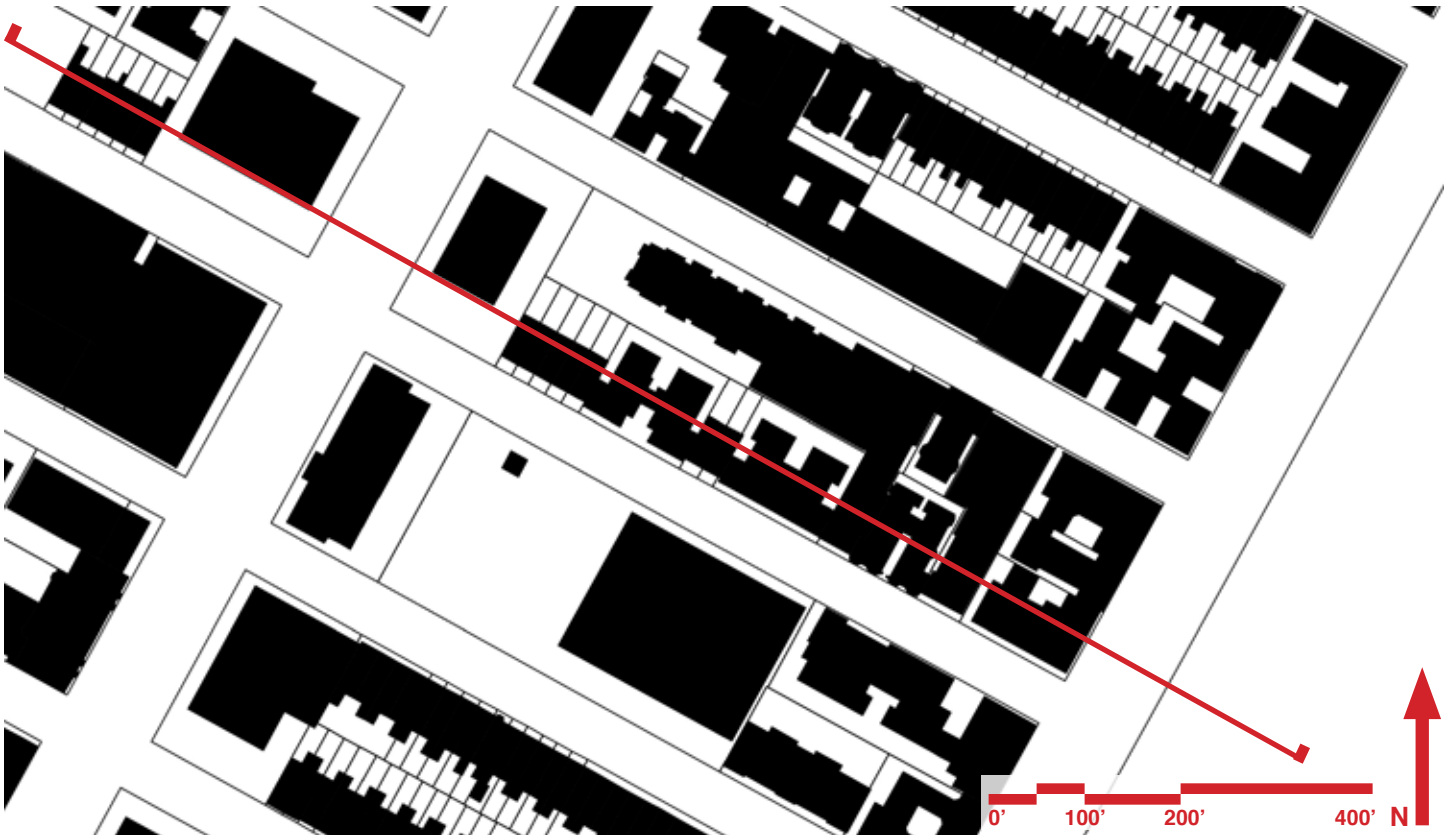
Orientation of Tower to Low Building:	East
Average Shadow Hours for Low Building:	0-6

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

Frontage on Central Park increases the real estate value and the building height for adjacent lots. This creates juxtapositions of density within blocks throughout most of the blocks that surround Central Park. In this case study, the frontage of lots is perpendicular, reducing the effects of the abrupt change in building height as buildings face either the park or the adjacent block, which are typically of similar character and scale. Narrow lots help to produce towers with reduced width and narrow blocks help to break up the block structure and groups of towers, bringing light and air toward the interior of each block.





JUXTAPOSITION OF DENSITY WITHIN BLOCKS: Chicago: Uptown

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	75'
Lot Width:	220'
Lot Area:	16500sf
High-Rise Building:	
Lot Depth:	225'
Lot Width:	245'
Lot Area:	55125sf
Block Size:	330'x1070'
Right of Way Width:	60'

Dimensions (Section)

Low-Rise Building:	
Height:	40'
Depth:	75'
Width:	40'
High-Rise:	
Height:	350'
Base Depth:	135'
Base Width:	225'
Tower Depth:	200'
Tower Width :	60'
Building Height Difference:	310'
Building Height Ratio:	8.75
High Bldg Height/Street Width Ratio:	5.83
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	89%
Low-Rise Building Depth/Lot Depth:	100%
High-Rise Tower Width/Lot Width:	24%
Low-Rise Building Width/Lot Width:	18%
High-Rise Tower Footprint/Lot Area:	22%
Space Between Buildings:	20'

Orientation

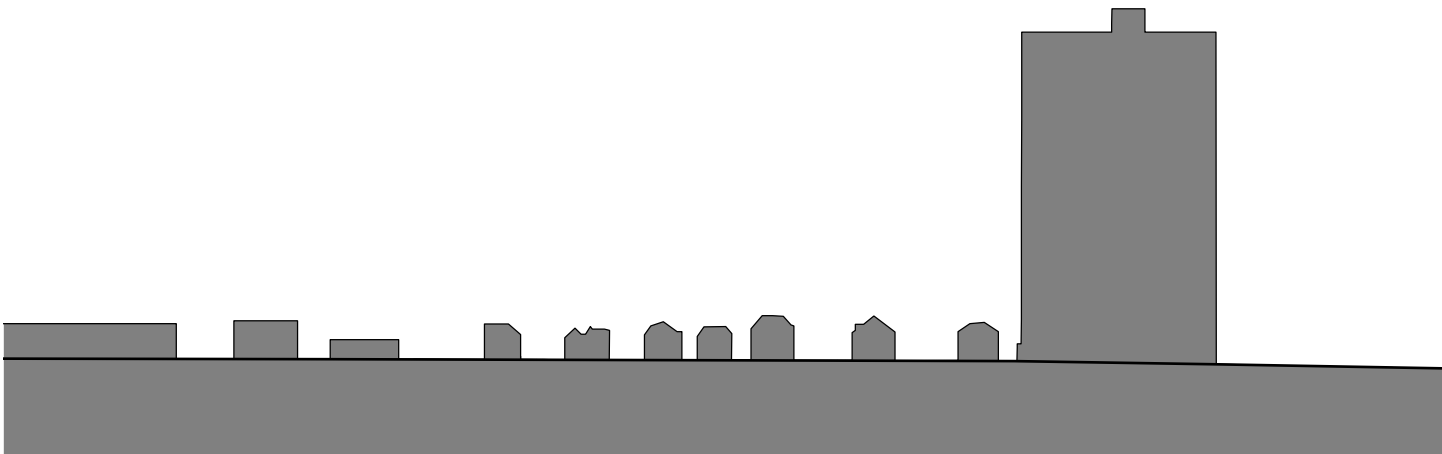
Orientation of Tower to Low Building:	East
Average Shadow Hours for Low Building:	0-6

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

The Uptown area of Chicago also features frontage on to greenspace (In this case the Lake Michigan Lake-front), which produces higher real estate values and building heights. This case study is set apart from others due to the distance from the city center and more suburban nature of the area. Even with a very stark juxtaposition of a 350 foot high building to adjacent single family homes, the urban form address the juxtaposition of density through narrow lots, producing slender towers, as well as lot frontages that are perpendicular to one another, ensuring that the narrow dimensions of towers face the lower buildings.





JUXTAPOSITION OF DENSITY WITHIN BLOCKS: Philadelphia: Rittenhouse Square

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	Yes

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	105'
Lot Width:	18'
Lot Area:	1890sf
High-Rise Building:	
Lot Depth:	100'
Lot Width:	100'
Lot Area:	10000sf
Block Size:	230'x392'
Right of Way Width:	25' (Alley)

Dimensions (Section)

Low-Rise Building:	
Height:	50'
Depth:	90'
Width:	18'
High-Rise:	
Height:	190'
Base Depth:	100'
Base Width:	42'
Tower Depth:	100'
Tower Width :	42'
Building Height Difference:	140'
Building Height Ratio:	3.80
High Bldg Height/Street Width Ratio:	7.60
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	100%
Low-Rise Building Depth/Lot Depth:	88%
High-Rise Tower Width/Lot Width:	42%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	42%
Space Between Buildings:	37'

Orientation

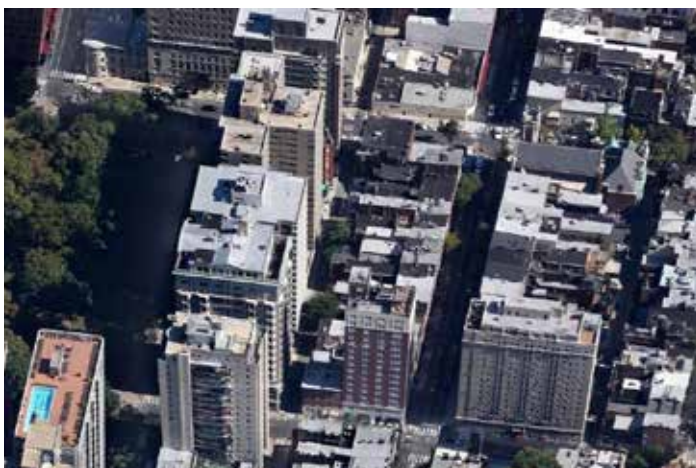
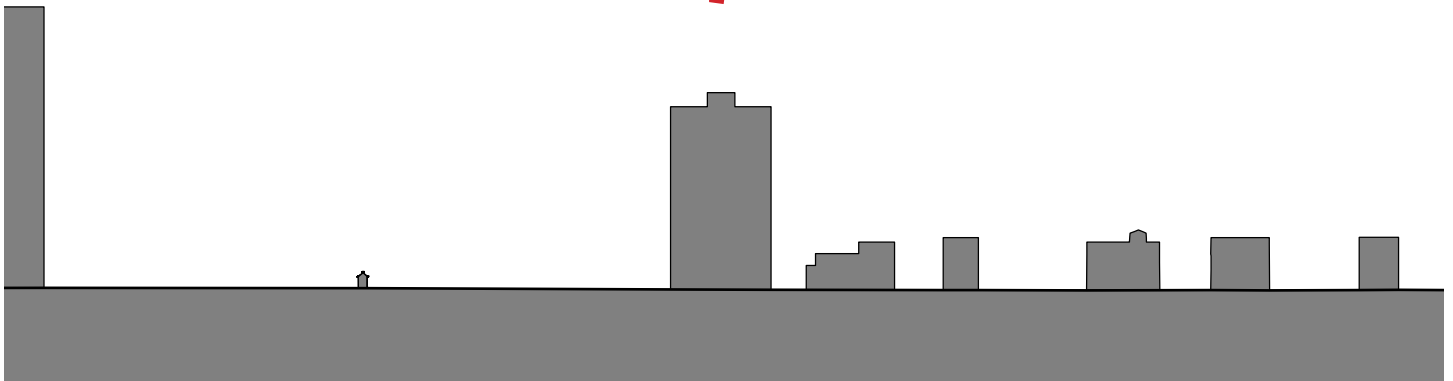
Orientation of Tower to Low Building:	North
Average Shadow Hours for Low Building:	0-1

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

Rittenhouse Square also presents juxtapositions of density within blocks as lots face the square, producing higher building heights. Orientation is very important in this case study as taller buildings are located north of lower buildings, ensuring that their shadows do not effect the lower buildings. The blocks also benefit from an alley that splits the block (and the juxtaposition) in two, helping to transition between the differing heights. Additionally narrow lots help to produce narrower towers, preventing the formation of a large wall around the square, a benefit for the public in the square as well as adjacent private landowners.





JUXTAPOSITION OF DENSITY WITHIN BLOCKS (Poor Example): Atlanta: Brookwood

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	320'
Lot Width:	75'
Lot Area:	24000sf
High-Rise Building:	
Lot Depth:	320'
Lot Width:	315'
Lot Area:	100800sf
Block Size:	1080'x1125'
Right of Way Width:	80'

Dimensions (Section)

Low-Rise Building:	
Height:	30'
Depth:	75'
Width:	30'
High-Rise:	
Height:	290'
Base Depth:	260'
Base Width:	280'
Tower Depth:	270'
Tower Width :	220'
Building Height Difference:	260'
Building Height Ratio:	9.67
High Bldg Height/Street Width Ratio:	3.63
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	84%
Low-Rise Building Depth/Lot Depth:	23%
High-Rise Tower Width/Lot Width:	70%
Low-Rise Building Width/Lot Width:	40%
High-Rise Tower Footprint/Lot Area:	59%
Space Between Buildings:	50'

Orientation

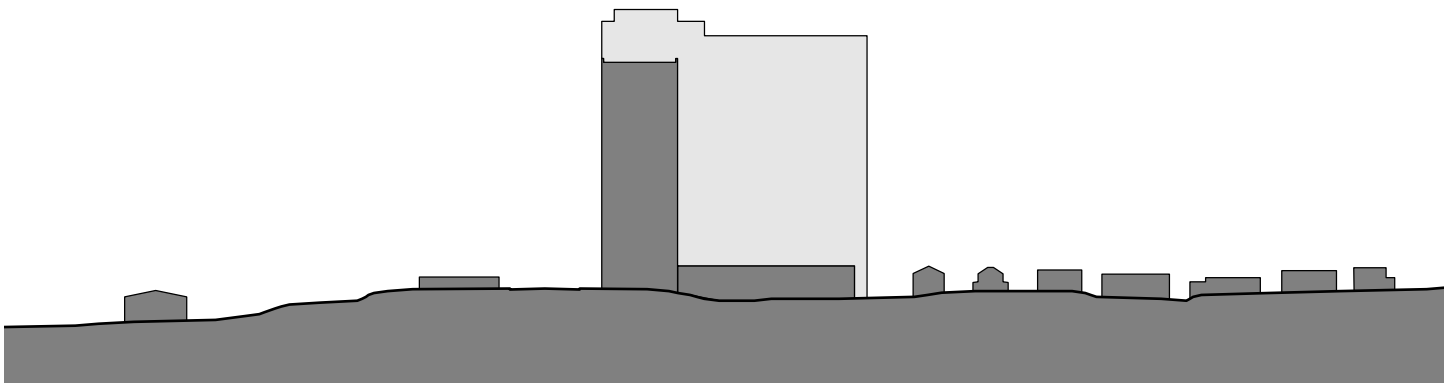
Orientation of Tower to Low Building:	East
Average Shadow Hours for Low Building:	7

Topography

Difference in topography:	3'
Angle of Slope:	1%
Direction of Slope from Low Building:	Above

Located north of Midtown Atlanta, the Brookwood area features a common condition in Atlanta and other cities where high traffic arterial roads bisect low density residential neighborhoods. Here, the close proximities of elastic tissues fronting the arterial and the static tissues of the neighborhoods create juxtapositions of density that operate within a poor urban context. Lots are larger and accommodate large projects (As seen here, the tower stretches 220' in width and 270' in depth), while the static urban tissue of the neighborhoods cannot accommodate different building types.





JUXTAPOSITION OF DENSITY BETWEEN BLOCKS: New York: Upper West Side

Dimensional Qualities:

Subdivision

Facing Lot Direction:	0°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	17'
Lot Area:	1700sf
High-Rise Building:	
Lot Depth:	100'
Lot Width:	50'
Lot Area:	5000sf
Block Size:	200'x450'
Right of Way Width:	55'

Dimensions (Section)

Low-Rise Building:	
Height:	55'
Depth:	17'
Width:	60'
High-Rise:	
Height:	170'
Base Depth:	155'
Base Width:	105'
Tower Depth:	155'
Tower Width :	105'
Building Height Difference:	115'
Building Height Ratio:	3.09
High Bldg Height/Street Width Ratio:	3.09
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	100%
Low-Rise Building Depth/Lot Depth:	17%
High-Rise Tower Width/Lot Width:	100%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	100%
Space Between Buildings:	68'

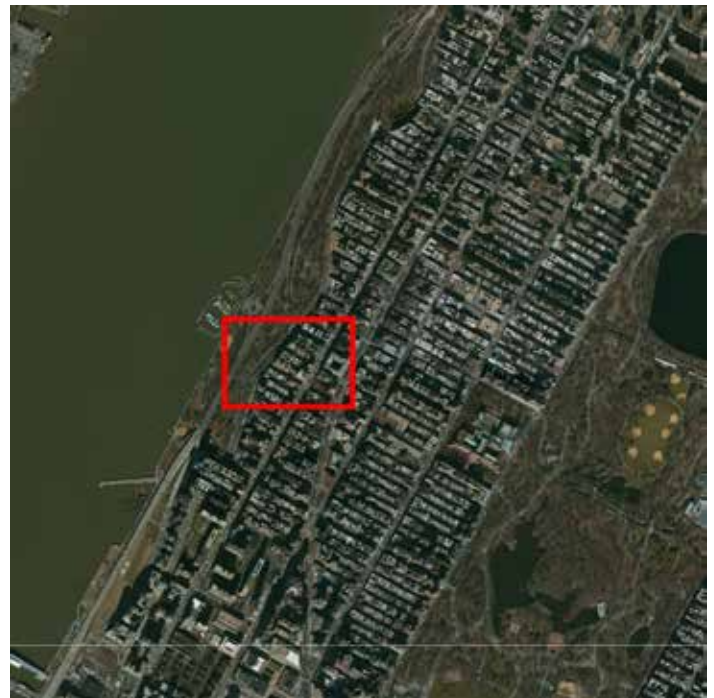
Orientation

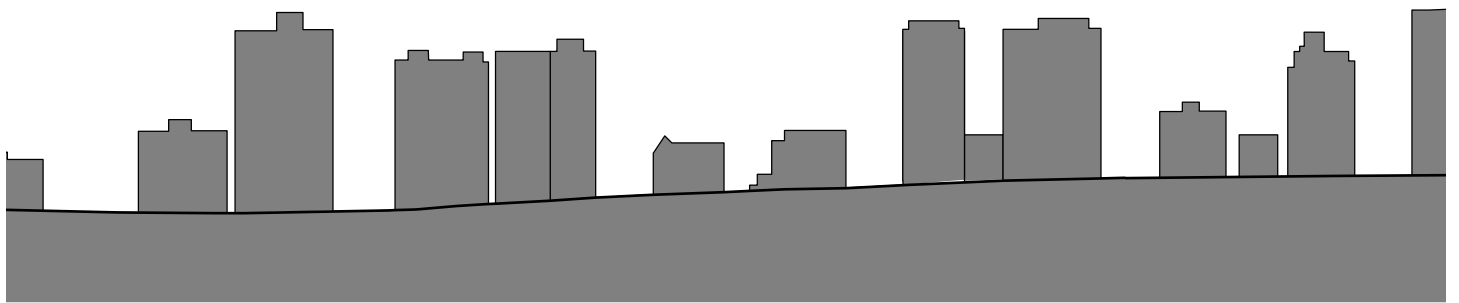
Orientation of Tower to Low Building:	North/South
Average Shadow Hours for Low Building:	5

Topography

Difference in topography:	3'
Angle of Slope:	4%
Direction of Slope from Low Building:	Up/Down

On the Upper West Side of Manhattan along Riverside Drive, juxtapositions of density exist between blocks. As a part of a textured and complex urban fabric, the juxtapositions that occur here operate without many issues. Lots with limited widths produce towers with narrow widths and can help to create spacing between towers. The small block sizes break up and space out high-rise buildings between blocks. Variations in street width along with the rectilinear form of the blocks create different environments and scales for different areas of the blocks.





JUXTAPOSITION OF DENSITY BETWEEN BLOCKS: Chicago: State Street South of Downtown

Dimensional Qualities:

Subdivision

Facing Lot Direction:	0°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	25'
Lot Area:	2500sf
High-Rise Building:	
Lot Depth:	144'
Lot Width:	250'
Lot Area:	36000sf
Block Size:	225'x1130',330'-540'
Right of Way Width:	100'

Dimensions (Section)

Low-Rise Building:	
Height:	40'
Depth:	60'
Width:	20'
High-Rise:	
Height:	205'
Base Depth:	65'
Base Width:	225'
Tower Depth:	65'
Tower Width :	225'
Building Height Difference:	165'
Building Height Ratio:	5.13
High Bldg Height/Street Width Ratio:	2.05
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	45%
Low-Rise Building Depth/Lot Depth:	60%
High-Rise Tower Width/Lot Width:	90%
Low-Rise Building Width/Lot Width:	80%
High-Rise Tower Footprint/Lot Area:	41%
Space Between Buildings:	150'

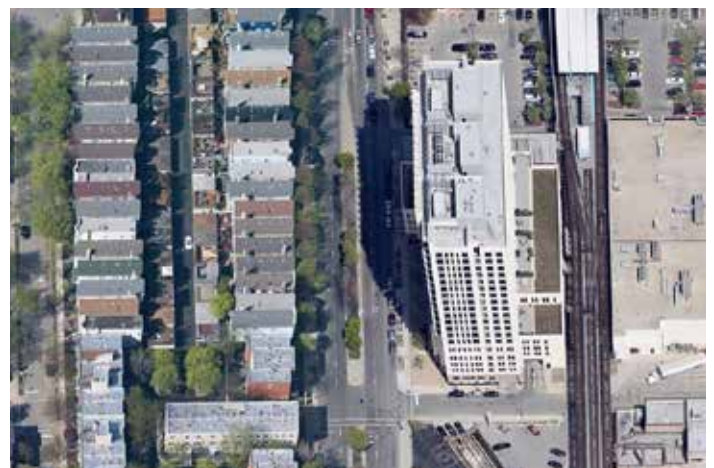
Orientation

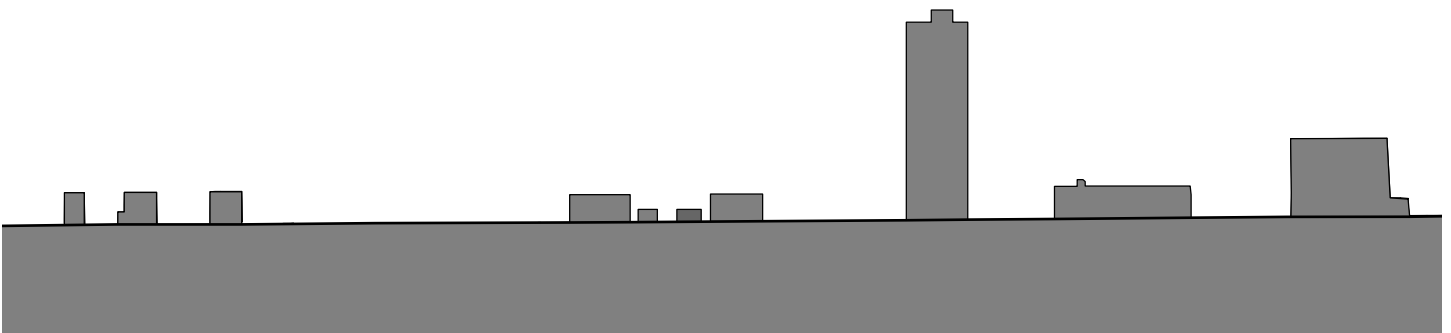
Orientation of Tower to Low Building:	East
Average Shadow Hours for Low Building:	0-3

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

Many juxtapositions of density operate well due to slender towers that allow light and air to reach adjacent low density buildings. On State Street south of Downtown Chicago, the condition is the opposite, where wide towers face low lying buildings. This juxtaposition of density between blocks still operates well as the width of State Street is 100 feet and the space between high and low buildings is 150 feet. This space allows a transition of the differing building heights as well as street trees along the street that can reduce the perception of the height of the tall towers.





JUXTAPOSITION OF DENSITY BETWEEN BLOCKS: Philadelphia: Rittenhouse Square

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	40'
Lot Width:	22'
Lot Area:	880sf
High-Rise Building:	
Lot Depth:	95'
Lot Width:	250'
Lot Area:	23750 sf
Block Size:	400'x240',230'-130'
Right of Way Width:	30'

Dimensions (Section)

Low-Rise Building:	
Height:	40'
Depth:	40'
Width:	22'
High-Rise:	
Height:	270'
Base Depth:	150'
Base Width:	60'
Tower Depth:	150'
Tower Width :	60'
Building Height Difference:	230'
Building Height Ratio:	6.75
High Bldg Height/Street Width Ratio:	9.00
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	100%
Low-Rise Building Depth/Lot Depth:	100%
High-Rise Tower Width/Lot Width:	24%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	38%
Space Between Buildings:	40'

Orientation

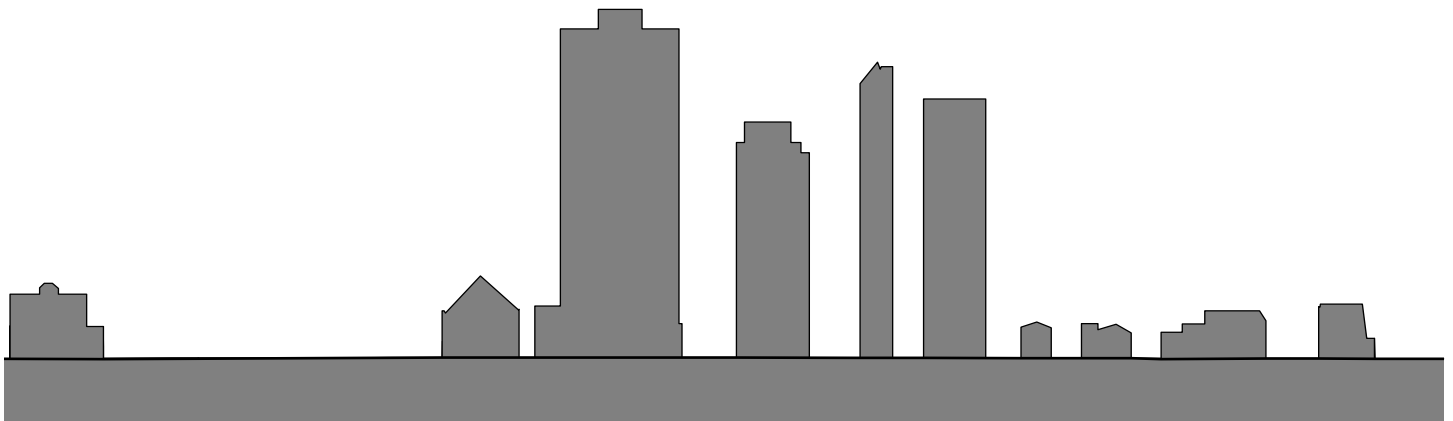
Orientation of Tower to Low Building:	North
Average Shadow Hours for Low Building:	0

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

One block away from the case study highlighted earlier, this juxtaposition of density between blocks operates well due to orientation, small lot sizes, and alleys. Although in this situation, the long dimension of the towers faces the low density buildings, the high-rise buildings are oriented north of the low buildings, ensuring that they are not effected by shadows from the taller buildings and receive ample light. The complexity of the urban form with small lots, small blocks, and alleys also helps situate and integrate different scales of buildings into a cohesive urban form.





JUXTAPOSITION OF DENSITY BETWEEN BLOCKS (Poor Example): Houston: West Galleria

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	100'
Lot Width:	190'
Lot Area:	19000sf
High-Rise Building:	
Lot Depth:	390'
Lot Width:	525'
Lot Area:	204750sf
Block Size:	200'x420'-600'
Right of Way Width:	80'

Dimensions (Section)

Low-Rise Building:	
Height:	30'
Depth:	35'
Width:	115'
High-Rise:	
Height:	560'
Base Depth:	170'
Base Width:	300'
Tower Depth:	170'
Tower Width :	300'
Building Height Difference:	530'
Building Height Ratio:	18.67
High Bldg Height/Street Width Ratio:	7.00
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	44%
Low-Rise Building Depth/Lot Depth:	35%
High-Rise Tower Width/Lot Width:	57%
Low-Rise Building Width/Lot Width:	61%
High-Rise Tower Footprint/Lot Area:	25%
Space Between Buildings:	190'

Orientation

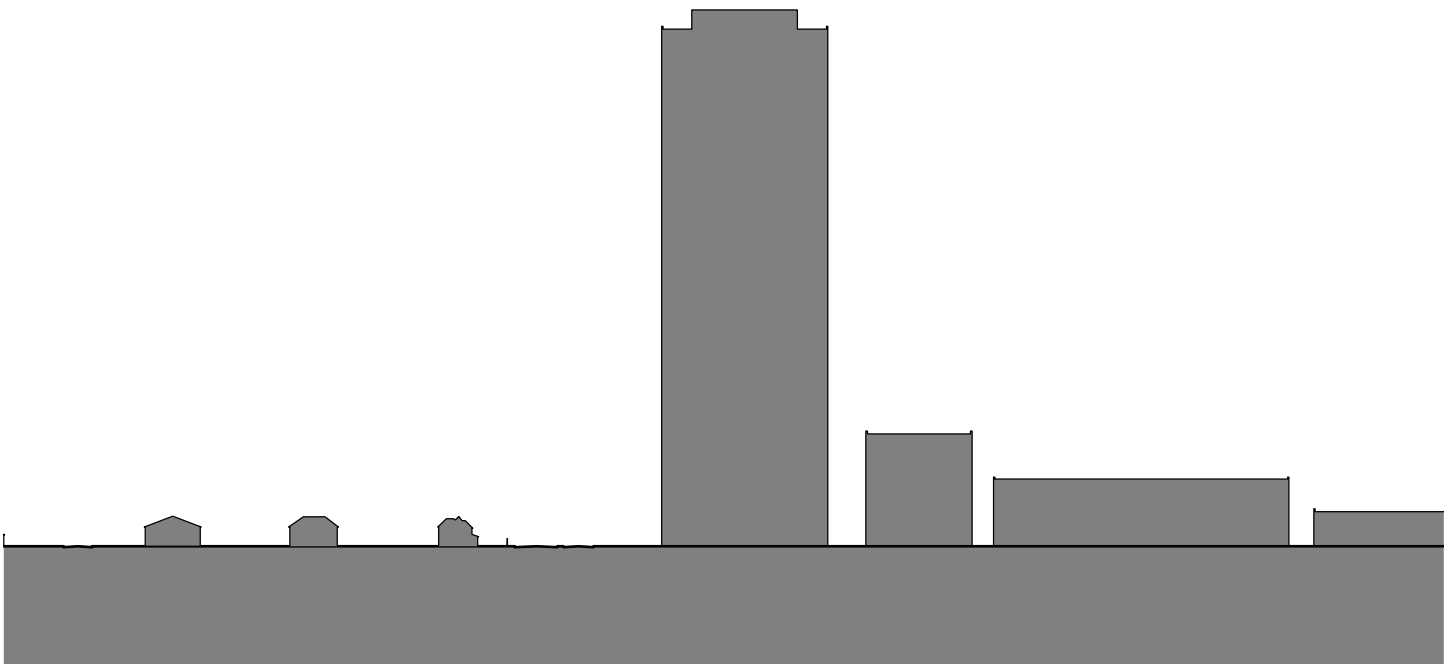
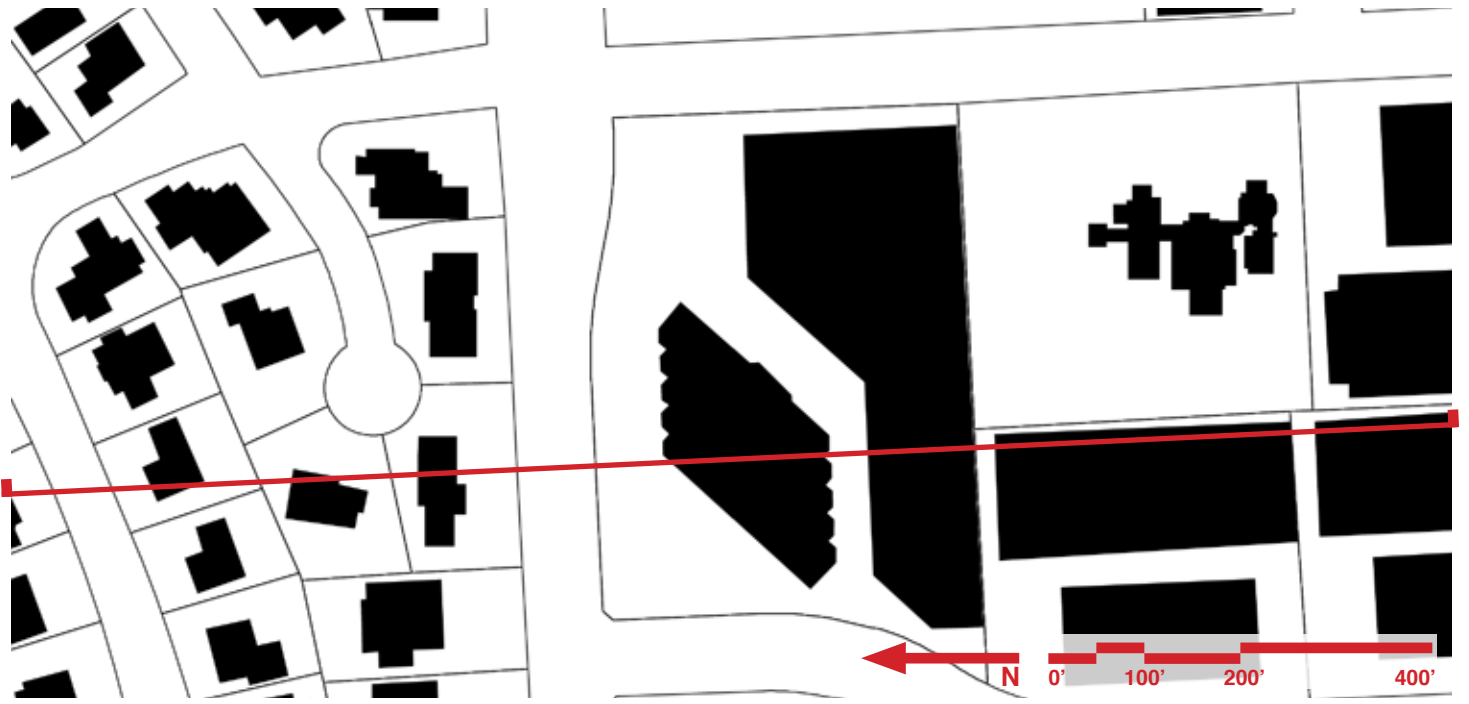
Orientation of Tower to Low Building:	South
Average Shadow Hours for Low Building:	6+

Topography

Difference in topography:	0'
Angle of Slope:	0
Direction of Slope from Low Building:	N/A

This juxtaposition of density between blocks occurs between the campus tissue of the Marathon Oil Building and the static tissue of the adjacent neighborhood of single family homes. The issues surrounding the juxtaposition are compounded through poor urban form with large blocks, cul-de-sacs, and poor lot frontages. Here the qualities of campus tissue allow an almost unlimited footprint and height (560 feet) of the tower to rise above the adjacent neighborhood. The southern orientation of the building increases issues as it casts a large shadow over many adjacent properties.





JUXTAPPOSITION OF DENSITY

TOPOGRAPHY:

Seattle: Vine Street

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	250'
Lot Width:	175'
Lot Area:	43750sf
High-Rise Building:	
Lot Depth:	250'
Lot Width:	175'
Lot Area:	43750sf
Block Size:	250'x360'
Right of Way Width:	100'

Dimensions (Section)

Low-Rise Building:	
Height:	40'
Depth:	52'
Width:	40'
High-Rise:	
Height:	135'
Base Depth:	60'
Base Width:	165'
Tower Depth:	60'
Tower Width :	165'
Building Height Difference:	95'
Building Height Ratio:	3.38
High Bldg Height/Street Width Ratio:	1.35
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	24%
Low-Rise Building Depth/Lot Depth:	21%
High-Rise Tower Width/Lot Width:	94%
Low-Rise Building Width/Lot Width:	23%
High-Rise Tower Footprint/Lot Area:	23%
Space Between Buildings:	18'

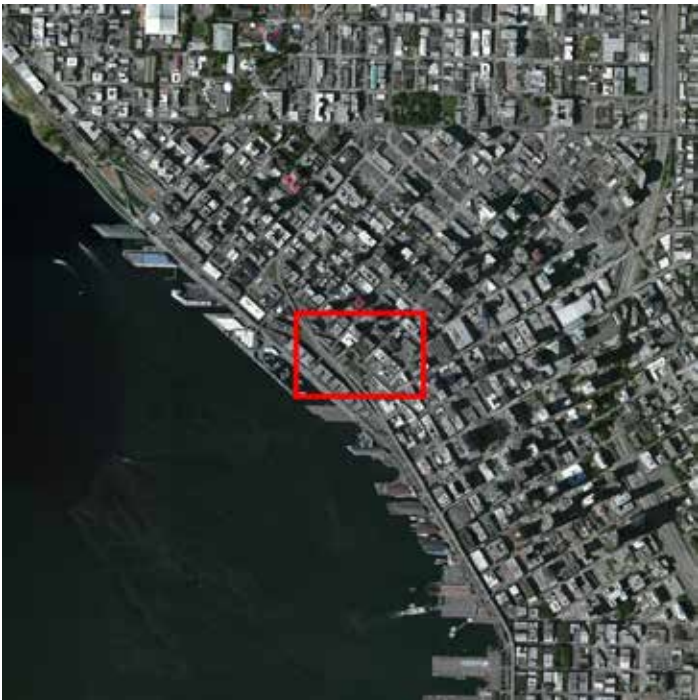
Orientation

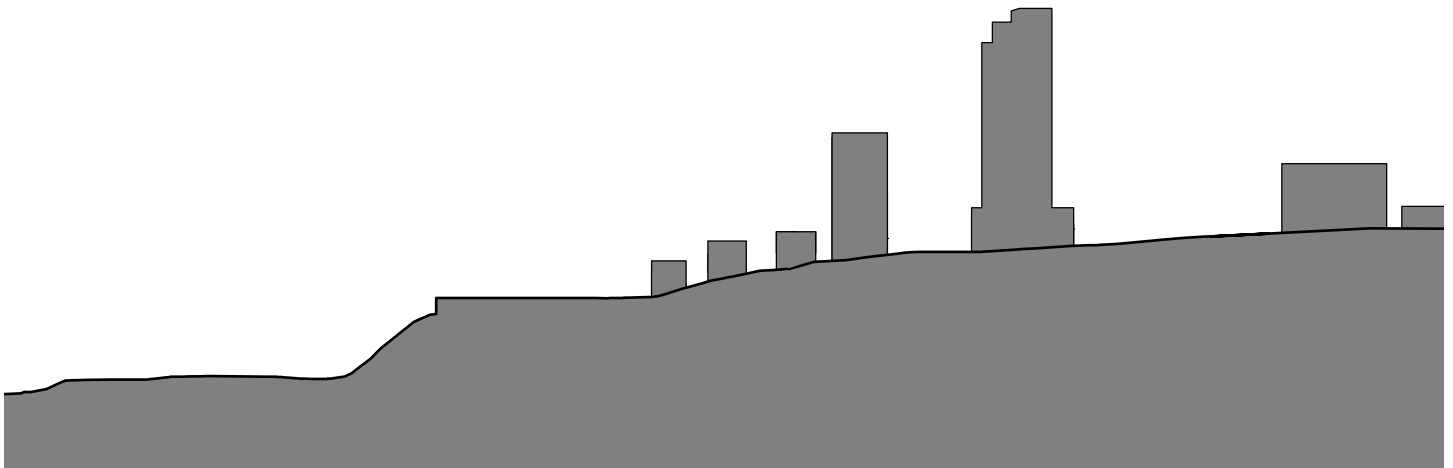
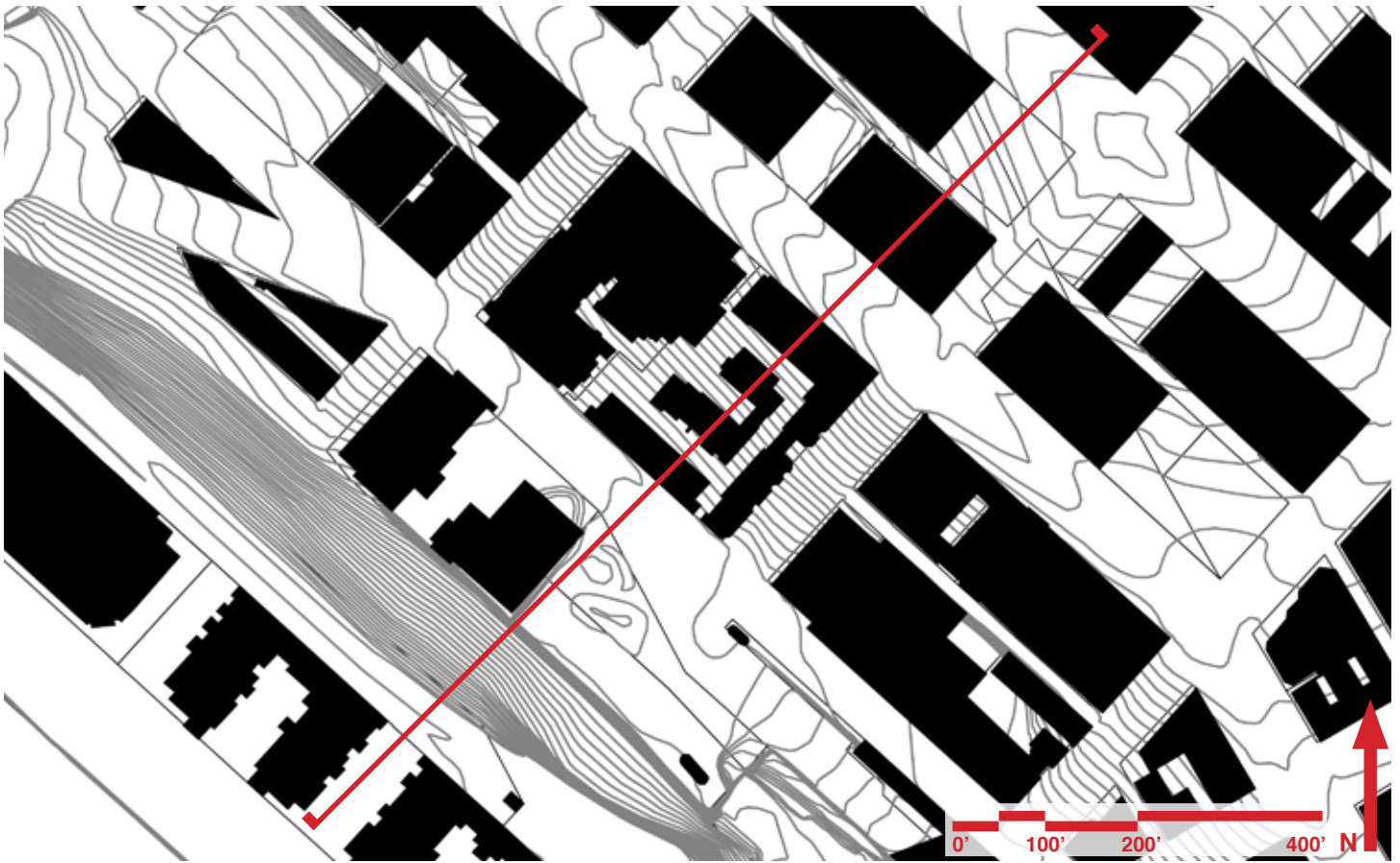
Orientation of Tower to Low Building:	Northeast
Average Shadow Hours for Low Building:	0-2

Topography

Difference in topography:	11'
Angle of Slope:	19%
Direction of Slope from Low Building:	Up

Vine Street, north of downtown Seattle features a juxtaposition of density within the block which is characterized by a large change in topography. In this case study, lots front opposite directions, with the low-rise buildings facing Puget Sound. Here, the topography helps mitigate issues of the juxtaposition of density by encouraging views down the hill, toward the Sound and away from the high-rise building, even though the higher elevation increases the height of the high-rise building relative to the low-rise buildings.





JUXTAPOSITION OF DENSITY

TOPOGRAPHY:

San Francisco: Gough Street

Dimensional Qualities:

Subdivision

Facing Lot Direction:	90°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	120'
Lot Width:	85'
Lot Area:	10200sf
High-Rise Building:	
Lot Depth:	140'
Lot Width:	130'
Lot Area:	18200sf
Block Size:	410'x225'
Right of Way Width:	70'

Dimensions (Section)

Low-Rise Building:	
Height:	60'
Depth:	95'
Width:	75'
High-Rise:	
Height:	130'
Base Depth:	115'
Base Width:	120'
Tower Depth:	115'
Tower Width :	120'
Building Height Difference:	70'
Building Height Ratio:	2.17
High Bldg Height/Street Width Ratio:	1.86
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	82%
Low-Rise Building Depth/Lot Depth:	79%
High-Rise Tower Width/Lot Width:	92%
Low-Rise Building Width/Lot Width:	88%
High-Rise Tower Footprint/Lot Area:	76%
Space Between Buildings:	35'

Orientation

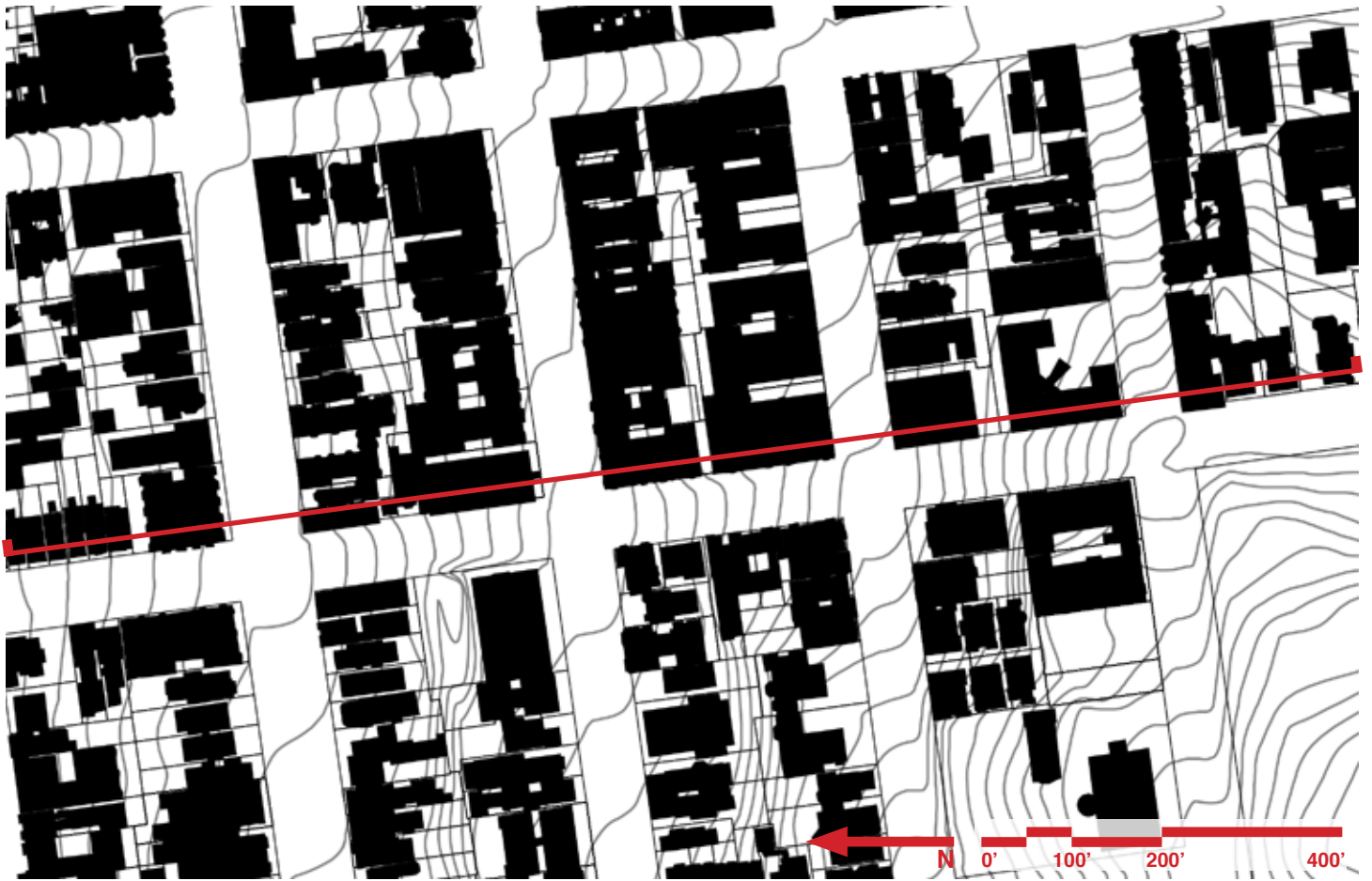
Orientation of Tower to Low Building:	North/South
Average Shadow Hours for Low Building:	0-1

Topography

Difference in topography:	27'
Angle of Slope:	19%
Direction of Slope from Low Building:	Up

Within Pacific Heights, this juxtaposition of density occurs both between blocks and within blocks along with great changes in topography. Here, the topography functions to create stepped transitions down the hill. Each street has buildings of similar height, and the transition between building heights that accounts for the change in topography occurs midblock. Lots face opposite directions within each block, allowing them to face adjacent blocks that feature a similar character and scale instead of facing buildings of different heights and scales.





JUXTAPOSITION OF DENSITY

TOPOGRAPHY:

San Francisco: Laguna Street

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	110'
Lot Width:	25'
Lot Area:	2750sf
High-Rise Building:	
Lot Depth:	140'
Lot Width:	140'
Lot Area:	19600sf
Block Size:	410'x225'
Right of Way Width:	70'

Dimensions (Section)

Low-Rise Building:	
Height:	30'
Depth:	75'
Width:	25'
High-Rise:	
Height:	135'
Base Depth:	120'
Base Width:	50'
Tower Depth:	90'
Tower Width :	50'
Building Height Difference:	105'
Building Height Ratio:	4.50
High Bldg Height/Street Width Ratio:	1.93
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	64%
Low-Rise Building Depth/Lot Depth:	68%
High-Rise Tower Width/Lot Width:	36%
Low-Rise Building Width/Lot Width:	100%
High-Rise Tower Footprint/Lot Area:	23%
Space Between Buildings:	70'

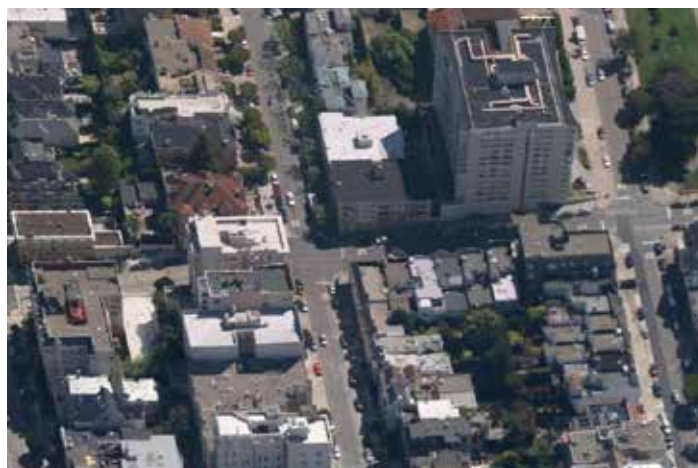
Orientation

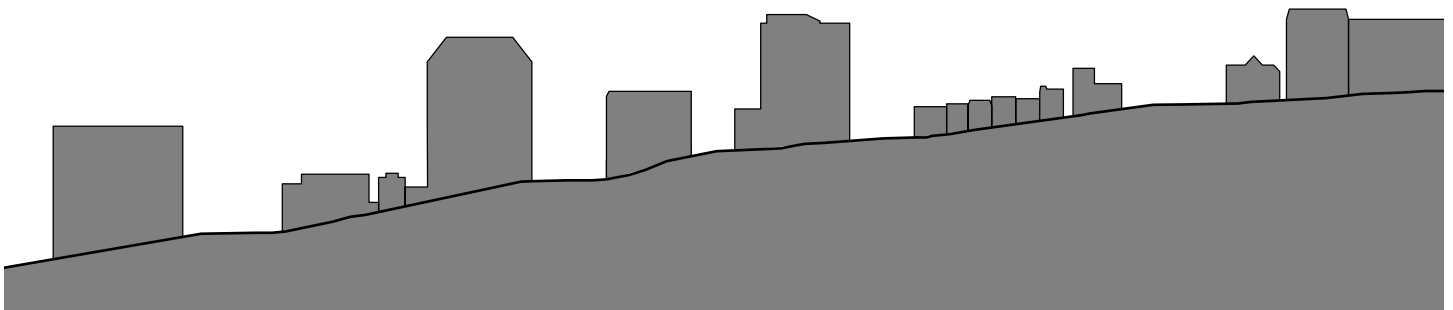
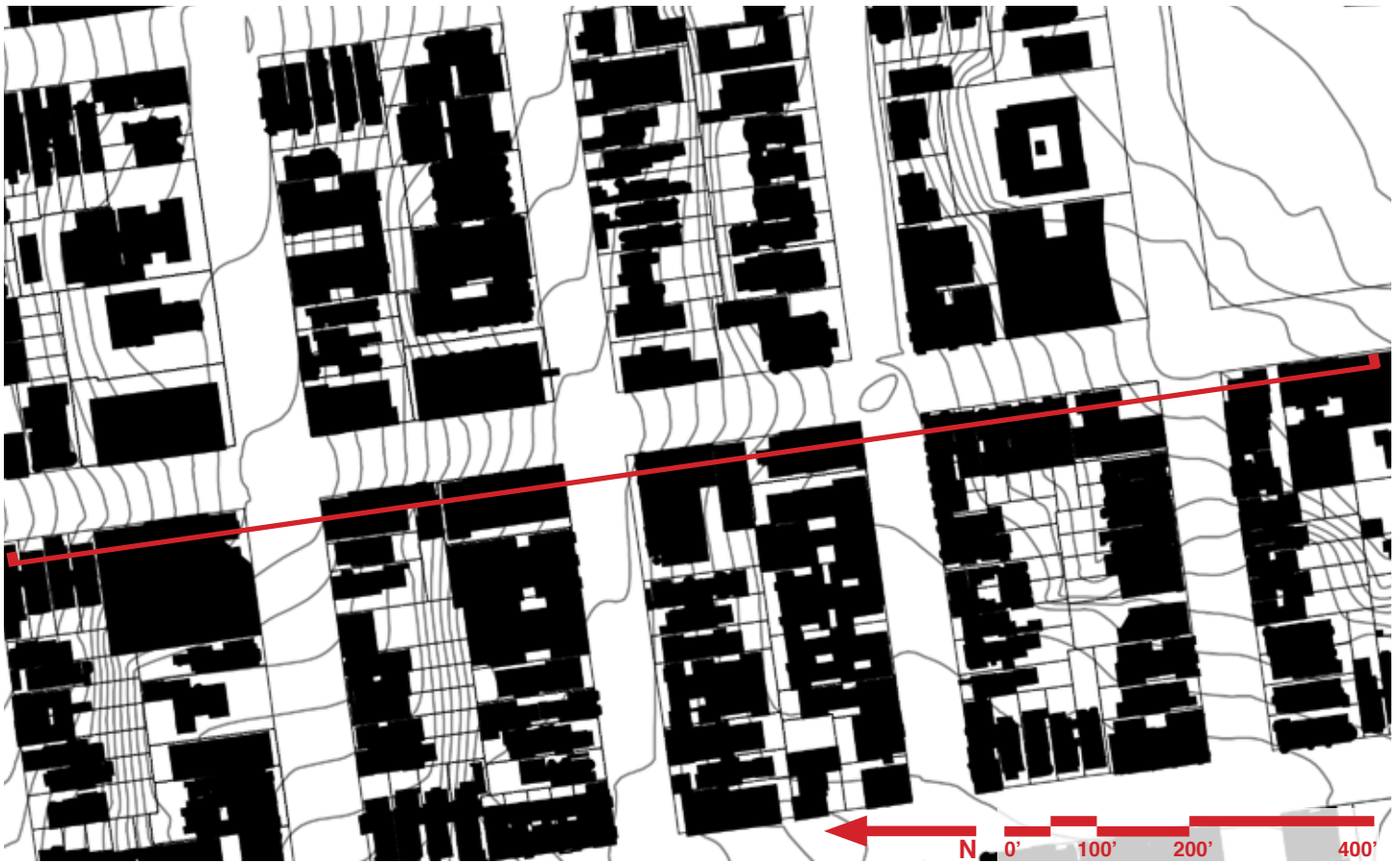
Orientation of Tower to Low Building:	South
Average Shadow Hours for Low Building:	0-1

Topography

Difference in topography:	14'
Angle of Slope:	14%
Direction of Slope from Low Building:	Down

Similar to the case study on Gough Street, this case study, also in Pacific Heights, along Laguna Street features juxtapositions of density between blocks and juxtapositions of density within blocks, along with large changes in topography. Here, lot frontages help address the changes in density as the lots do not front buildings of different heights. Instead they have frontages perpendicular to one another, or frontages facing opposite directions. Narrow lot widths also help to encourage limited widths on high-rise buildings.





JUXTAPOSITION OF DENSITY

TOPOGRAPHY:

Atlanta: 16th Street and Ansley Park

Dimensional Qualities:

Subdivision

Facing Lot Direction:	180°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	300'
Lot Width:	75'
Lot Area:	22500sf
High-Rise Building:	
Lot Depth:	340'
Lot Width:	200'
Lot Area:	38000sf
Block Size:	710'x650'
Right of Way Width:	80' 12' (Alley)

Dimensions (Section)

Low-Rise Building:	
Height:	35'
Depth:	80'
Width:	45'
High-Rise:	
Height:	270'
Base Depth:	290'
Base Width:	200'
Tower Depth:	155'
Tower Width :	100'
Building Height Difference:	235'
Building Height Ratio:	7.71
High Bldg Height/Street Width Ratio:	3.38
Transitional Height Angle:	43°
High-Rise Tower Depth/Lot Depth:	46%
Low-Rise Building Depth/Lot Depth:	27%
High-Rise Tower Width/Lot Width:	50%
Low-Rise Building Width/Lot Width:	60%
High-Rise Tower Footprint/Lot Area:	23%
Space Between Buildings:	185'

Orientation

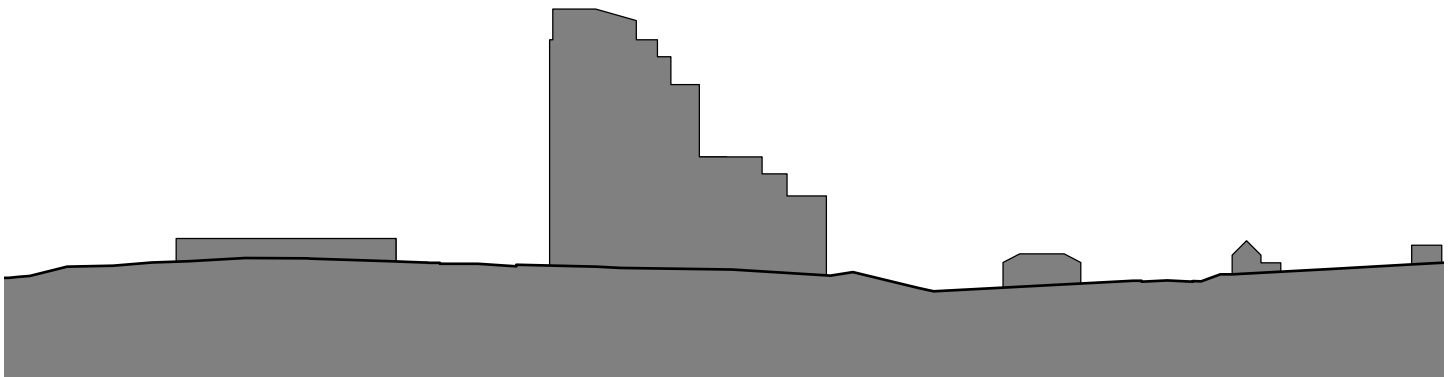
Orientation of Tower to Low Building:	Southwest
Average Shadow Hours for Low Building:	0-1

Topography

Difference in topography:	23'
Angle of Slope:	14%
Direction of Slope from Low Building:	Above

This case study illustrates a juxtaposition of density within a block and with a great change in elevation. This case study shows the juxtaposition of density between the elastic tissue adjacent to Peachtree Street and the static tissue of Ansley Park. While it does not feature resilient tissue, the juxtaposition of density functions well due to the depth of the lots, the change in topography, orientation, and the alley that bisects the block. These features help to breakup an otherwise large lot, allowing this case study to function more like it has resilient tissue .





JUXTAPOSITION OF DENSITY

TOPOGRAPHY (Poor Example):

Los Angeles: Wilshire Boulevard

Dimensional Qualities:

Subdivision

Facing Lot Direction:	0°
Face Greenspace:	No

Dimensions (Plan)

Low-Rise Building:	
Lot Depth:	135'
Lot Width:	60'
Lot Area:	8100sf
High-Rise Building:	
Lot Depth:	135'
Lot Width:	335'
Lot Area:	50250sf
Block Size:	290'x950'
Right of Way Width:	170'

Dimensions (Section)

Low-Rise Building:	
Height:	30'
Depth:	65'
Width:	50'
High-Rise:	
Height:	160'
Base Depth:	70'
Base Width:	300'
Tower Depth:	70'
Tower Width :	300'
Building Height Difference:	130'
Building Height Ratio:	5.33
High Bldg Height/Street Width Ratio:	2.00
Transitional Height Angle:	0°
High-Rise Tower Depth/Lot Depth:	47%
Low-Rise Building Depth/Lot Depth:	48%
High-Rise Tower Width/Lot Width:	90%
Low-Rise Building Width/Lot Width:	83%
High-Rise Tower Footprint/Lot Area:	42%
Space Between Buildings:	105'

Orientation

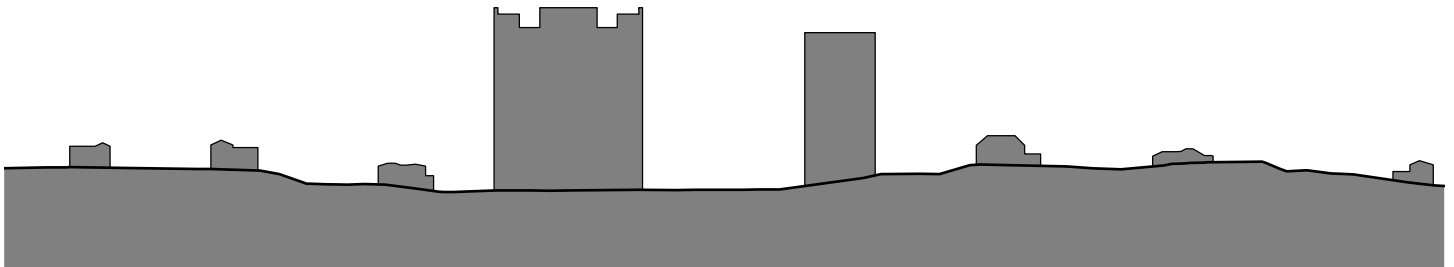
Orientation of Tower to Low Building:	Southeast
Average Shadow Hours for Low Building:	6+

Topography

Difference in topography:	22
Angle of Slope:	12%
Direction of Slope from Low Building:	Below

This case study is a prime example of an arterial road surrounded by elastic tissue bisecting an area of static tissue. Here the juxtapositions of density are very abrupt and intensified through topography. Wide buildings along Wilshire Boulevard block views and light from the adjacent properties. This is a direct result from wide parcels fronting Wilshire Boulevard. With single family homes at a higher elevation than the high-rise buildings, the topography situates them so that they front and view the sides of wide buildings. If the homes were located at a lower elevation, they would have views of a hillside instead of a tower.





CONCLUSIONS

How do juxtapositions of high-rise development and low-rise buildings operate in terms of urban form?

Juxtapositions of high-rise development and low-rise buildings operate within a complex urban fabric, produced by a resilient urban form that is comprised of small lots and small blocks. Within the resilient urban form, changes to the urban structure are very difficult, but changes within the structure (buildings, uses, etc.), are accommodated, producing an urban complexity with differing scales, buildings types, and uses.

The changing nature of the built environment within resilient urban tissues mitigates the effects of juxtapositions of high-rise buildings and low-rise buildings. Variations in scale and building help form a complex urban fabric, where these juxtapositions are not deviations to the scale of the surroundings, but a integral part of the fabric. The urban form accommodates juxtapositions of high and low density; it does not suppress them. This fact illustrates the clear difference between juxtapositions within resilient urban tissues and juxtapositions within suburban tissues (elastic and static).

Resilient urban tissues accommodate juxtapositions of high and low density, integrating them into a larger fabric of changing scales and building types. Elastic and static tissues found in suburban areas highlight the differences in scale produced by juxtapositions of density. They become the exception to the built environment, rather than part of the norm.

Small lots and small blocks help to mitigate differences produced by juxtapositions of density, while still allowing a diversity of building types. Small and narrow lots help limit building profiles, allowing increased spacing between high-rise buildings, allowing more light and air to reach low-rise buildings. Small lots also produce smaller building types, discouraging block-wide large scale development. Small blocks help to break up the urban form, producing more street frontage and increased levels of light and air.

Increased distance between high buildings and low buildings can also help address issues of high-rise buildings in close proximity to low-rise buildings. Wide streets increase the distance between buildings, reducing the possible towering effect of taller buildings. In addition, wide streets can feature several rows of street trees which can obstruct views of tall buildings and institute a more pedestrian scale for the street and for private development. Deep lots also help to reduce the effects of juxtapositions of high and low density through increased spacing of buildings and an emphasis on the construction of long, thin buildings.

Orientation also plays a vital role in the juxtaposition of high-rise and low-rise buildings. Tall buildings to the north of low buildings do not have much effect on the solar exposure of the adjacent low buildings. Tall buildings to the east or west of low buildings typically affect the solar environment of the adjacent low buildings in just the morning or evening, while tall buildings to the south can have a greater effect through the day. The form of buildings also has a great influence on solar exposure. Thin, narrow buildings with wide spacing, regardless of orientation help to bring more light to streets and adjacent properties. In this case, profile is more important than height. Greenspaces also help with solar exposure to bring openness and light into the urban form.

While juxtapositions operate within a complex urban fabric, the specific operation of them within this fabric can be summarized into six different conclusions. Each conclusion features several characteristics related to subdivision, dimensions (plan and section), orientation, or topography. When these combinations of characteristics are present, juxtapositions of density operate well, although there are cases outside of these conclusions where juxtapositions of density work. The following page briefly introduces these conclusions, while the pages afterward illustrate the details of each conclusion and how it relates to the case studies.

Operation of Juxtapositions of Density: Combinations of Characteristics

Conclusion 1:

Lots Face Opposite Direction

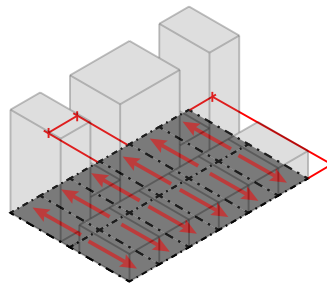
Narrow Lots

Juxtaposition Mid Block

Examples:

New York: 86th Street

Philadelphia: Rittenhouse Square



Conclusion 2:

Lots Face Different Direction (90°)

Narrow Block Width

Examples:

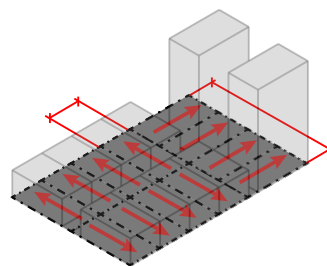
New York: Upper East Side Avenues

New York: Upper West Side/Central Park

Chicago: Uptown

Philadelphia: Rittenhouse Square

Seattle: Vine Street



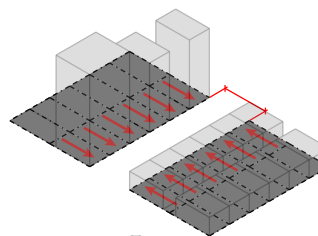
Conclusion 3:

Lots Face Each Other

Distance Between Buildings >100'

Examples:

Chicago: State Street



Conclusion 4:

Lots Face Opposite Direction

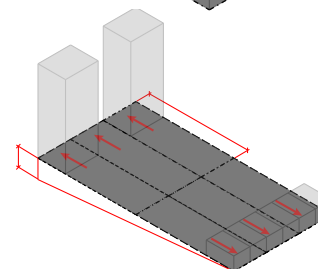
Deep Lots

Topography Descends From Tall Buildings

Examples;

Seattle: Vine Street

Atlanta: 16th Street and Ansley Park



Conclusion 5:

Lots Face Opposite Direction

Tower Width < 80'

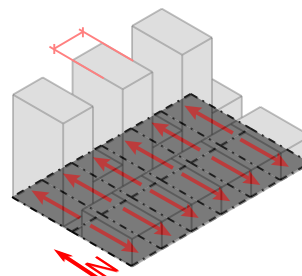
Tall Buildings North of Low Buildings

Examples:

New York: 86th Street

Philadelphia: Rittenhouse Square

Seattle: Vine Street



Conclusion 6:

Lots Face Different Direction (90°)

Narrow Lot Width

Tower Width < 80'

Tall Buildings East/West of Low Buildings

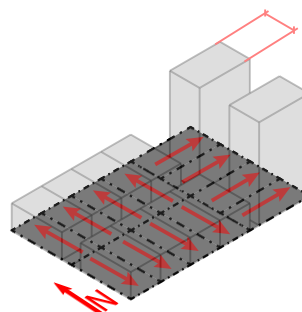
Examples:

New York: Upper East Side Avenues

New York: Upper West Side/Central Park

Chicago: Uptown

San Francisco: Franklin Street



Conclusion 1:

Lots Face Opposite Direction

Narrow Lots

Juxtaposition Mid Block

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths <300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50'< Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width<80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Width of Lots:

New York: 17' - 80'

Philadelphia 18' - 100'

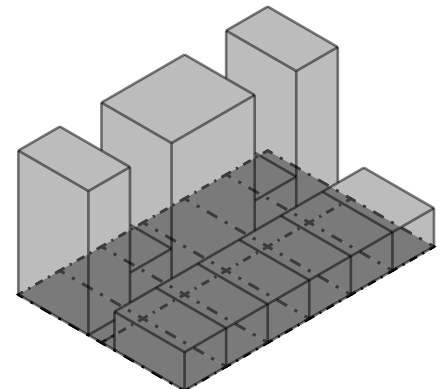
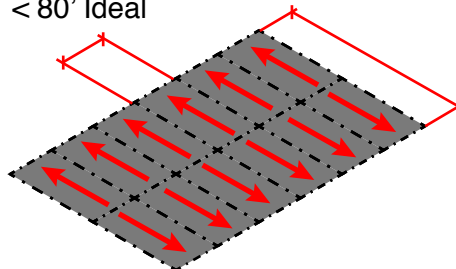
Width of Blocks:

New York: 200'

Philadelphia: 230'

Lot Width:
< 100'
< 80' Ideal

Block Width:
200' - 300'



[illegible]

Juxtapositions of density can produce favorable conditions when they occur mid-block with lots facing opposite directions and with narrow lots. With lots facing opposite directions within the block, a clear subdivision strategy is established, allowing lots to face outward toward adjacent blocks. If juxtapositions of high-rise buildings and low-rise buildings occur mid-block, this quality of the subdivision moves the focus away from the juxtaposition as it occurs in the rear of each lot. The focus of each property centers on the public realm of the street and the adjacent blocks. This focus on the exterior of the block allows the accommodation of a narrow dimension between high-rise buildings and low-rise buildings in the interior of the block, seen in New York with a spacing of 34' and in Philadelphia with 37'. The addition of alleyways can also further separate buildings from each other and reinforce the concept that the back of each lot is in the interior of the block.

Narrow lots also help constrain the width of tall buildings. With buildings limited to a narrow lot and taking on a thinner more slender form, more light and air are able to reach adjacent properties. Even though lots can be combined, it is very difficult to combine multiple lots to form massive and wide buildings. Narrow Lots also help encourage a finer grained urbanism, with frequent changes in building form from lot to lot, creating an interesting environment for pedestrians.

Conclusion 2:

Lots Face Different Direction (90°)

Narrow Block Width

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths <300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50' < Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width < 80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Width of Blocks:

New York Avenues: 200'

New York Central Park: 200'

Chicago: 330'

Philadelphia: 230'

Seattle: 250'

Lot Width:

< 100'

< 80' Ideal

Block Width:

200' - 360'

Length of Blocks:

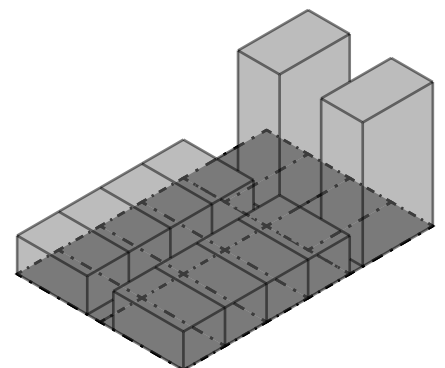
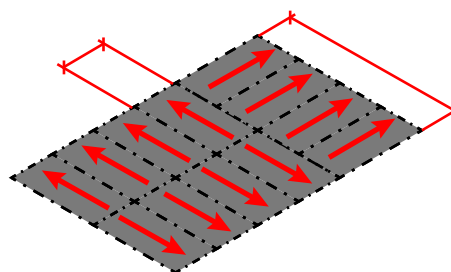
New York Avenues: 420-600'

New York Central Park: 800'

Chicago: 1068'

Philadelphia: 392'

Seattle: 360'



[illegible]

Juxtapositions of density can also produce favorable conditions when they occur mid-block with lots facing perpendicular to one another and with narrow block widths. When the subdivision of a block features lots that are situated at 90° angles to each other, facing the edge of each side of the block (See the Left Diagram), it produces many advantages through the urban form. The focus of each lot shifts from the juxtapositions of density that take place mid block to focus on the the exterior of the block, similar to where lots face opposite directions. Additionally, when lots are situated perpendicular to each other, the rear of some lots abut to the sides of adjacent lots, allowing the block structure to take advantage of the lot geometries. This orients high-rise buildings so that the narrow widths of towers will face the low-rise buildings, ensuring that additional light and air can reach these buildings. This condition is typical for high traffic roads, such as in New York, where lots face avenues on the sides of blocks, and face streets on the interior of blocks. It is also common with adjacent greenspace, as seen in Uptown Chicago where lots face adjacent parks and waterfronts on the sides of blocks, perpendicular to the orientation of lots in the remainder of the block.

Limited block widths also alleviate issues that can be present with juxtapositions of different densities. Small block widths help to break up the urban structure with streets, insuring greater spacing between tall buildings.

Conclusion 3:

Lots Face Each Other

Distance Between Buildings >100'

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths <300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50' < Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width < 80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Right of Way Width:

Chicago: 100'

Houston: 80'

Tall Building Height

Street Width Ratio $\leq 2:1$

Space Between Buildings:

Chicago: 150'

Houston: 190'

Tall Building Height/Street Width:

Chicago: 2:1

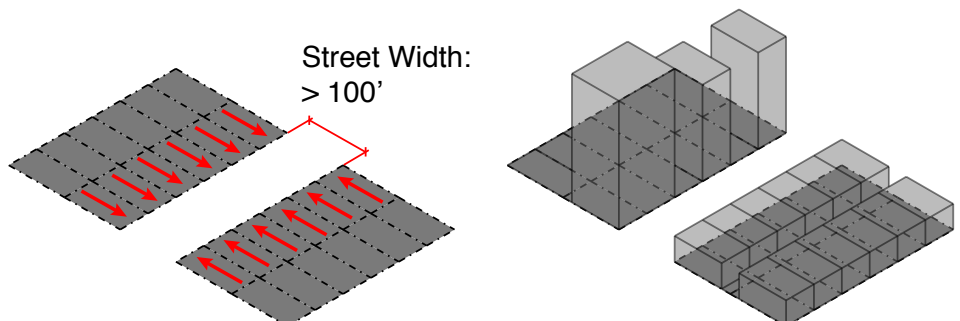
Houston: 7:1

Block Dimensions:

Chicago: 330' x 540', 225' x 1130'

Houston: 600' x 1500', 650' x 900'

50 | Juxtapositions of Density: The Relationship of Urban Form to Abrupt Variations in Density



[illegible]

When Juxtapositions of high and low buildings occur between two blocks, increasing the distance between buildings helps to mitigate the differences in scale between each block. This is especially true in instances where low buildings face wide high-rises instead of facing narrow towers that are spaced out across the block. In this case on State Street south of Downtown Chicago, low-rise townhomes face a 205' tall, 225' wide building. A 100' right of way and 150' space between the buildings help to decrease the perception of a drastic change in scales by widening the public realm and transforming the pedestrian environment. The increased right of way creates ample space for street trees both on sidewalks and medians to help create a more pedestrian scale environment in the presence of large buildings. The wide space between buildings also creates a ratio of building height to building spacing of 1.33:1 (The building height to street width ratio is 2:1), which helps produce a more pedestrian scaled environment. This spacing illustrates the importance of setbacks for the mass of buildings in the instance of juxtapositions of tall buildings and low-rise buildings.

Increasing street widths in reaction to juxtapositions of building scale also has limits, which the Houston Galleria case study exhibits. While the space between buildings is a large dimension at 190', the building height to buildings spacing ratio is still 3:1, and its building height to street width ratio is 7:1. The problems present in this case study are also compounded with poor subdivision conditions and poor solar orientation. Different subdivision, narrower, and shorter buildings would mitigate some of the issues inherent within the case study.

Conclusion 4:

Lots Face Opposite Direction

Deep Lots

Topography Descends From Tall Buildings

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths < 300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50' < Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width < 80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Tall Building Depth:
25% - 50% of lot depth

Depth of Lots:

Atlanta: 300' - 340'

Seattle: 250'

Change in Elevation:

Atlanta: 23'

Seattle: 11'

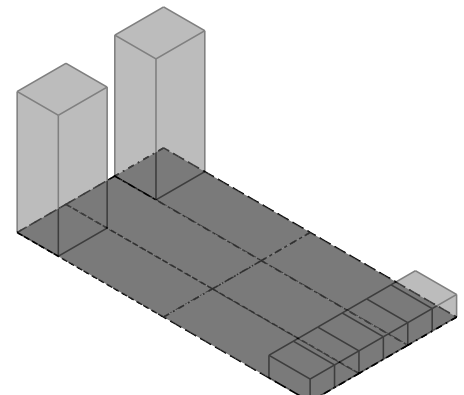
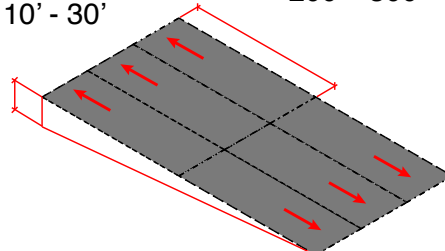
Average Slope:

Atlanta: 14%

Seattle: 19%

Range of Topo:
10' - 30'

Lot Depth:
200' - 300'



[illegible]

In some cases, changes in topography, especially where tall buildings exist at higher elevations than low-rise buildings, can heighten the perception of differing building scales. This issue can be controlled through the use of deep lots to create more space between buildings, and also through the frontage of lots in opposite directions within the block. With lots facing opposite directions, properties face the surrounding blocks which typically feature similar building scales. Deep lots help to space tall buildings from low-rise buildings and also help to accommodate changes in topography. The slope between buildings is reduced, decreasing the perception of the scale of the high-rise buildings from the low-rise buildings. This is evidenced through the case study in Atlanta on 16th Street near Ansley Park. The depth of the high-rise buildings exists within 46% of the lot depth in Atlanta and 24% of the lot depth in Seattle. These slopes are calculated from the distance between the rear of each building and their prospective elevations. With decreased spacing between buildings (In this case, the space between buildings in the Atlanta case study is 185'), the slope is less steep than it would be with closer building distances. This increased spacing also improves solar conditions for low-rise buildings, especially in the case where high-rise buildings are oriented toward the south of low-rise buildings, as is the case in the Atlanta case study.

Conclusion 5:

Lots Face Opposite Direction

Tower Width < 80'

No Shadow on Low Buildings

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths <300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50' < Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width < 80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Width of High-Rise Towers:

New York 86th St: 40'

Philadelphia: 42' - 60'

Seattle: 95'

Average Hours in Shadow for Low Buildings:

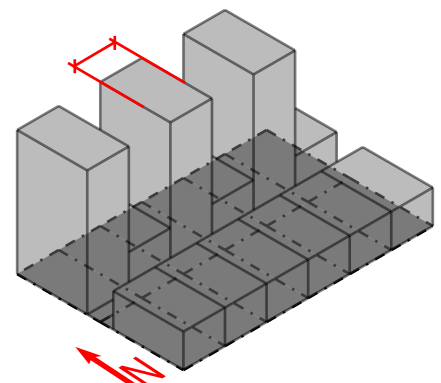
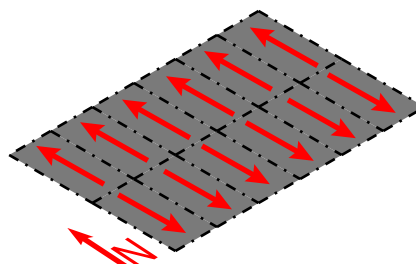
New York 86th St: 0-3

Philadelphia: 0-1

Seattle: 0-2

Lot Width:
< 100'
< 80' Ideal

Tower Width:
≤ 80'



Conclusion 6:

Lots Face Different Direction (90°)

Tower Width < 80'

Shadow on Low Buildings for only Part of the Day

MATRIX		Within Block				
		NY: Avenues	NY: 86th St	NY: Cen. Park	CHI: Uptown	PHL: R
Criteria	Subdivision					
	Lots Face Different Direction (90 degrees)					
	Lots Face Each Other					
	Lots Face Opposite Direction					
	Face Park/Openspace					
	Alleys Bisect Blocks					
	Dimensional Issues (Plan)					
	Lot Depth > 150' (Deep)					
	Lot Width < 80' (Narrow)					
	Small Block Widths <300'					
	Large Block Width > 300'					
	Wide Street Widths Between Blocks					
	Dimensional Issues (Section)					
	Distance Between Buildings < 50'					
	50' < Distance Between Buildings < 100'					
	Distance Between Buildings > 100'					
	Ratio of Building Height (Taller/Lower)	3.8	3	6.5	8.8	
	Transitional Height/Variable Height					
	Juxtaposition Within Block					
	Juxtaposition Between Blocks					
	Orientation					
	Tower Building Width < 80'					
	No Shadow on Low Buildings					
	Shadow on Low Buildings: Morning/Evening					
	Shadow on Low Buildings: Noon					
	Topography					
	Flat					
	Low Buildings Below Tall Buildings					
	Low Buildings Above Tall Buildings					
	Variable Slopes					

Case Study Dimensions:

Ideal Conditions:

Tower Width:
≤ 80'

Spacing Between Towers:

New York Avenues: 0', 30', 60'

New York Central Park: 40'

Chicago: 100'

San Francisco Franklin St: N/A

Lot Width:
< 100'
< 80' Ideal

Block Width:
200' - 300'

Tower Spacing:
≥ 100'

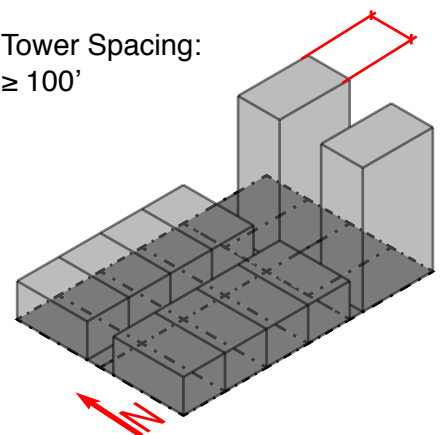
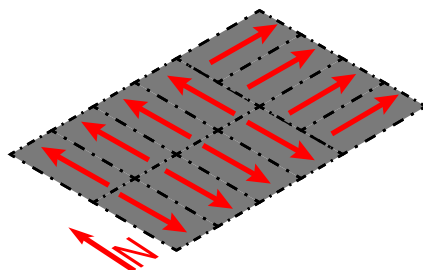
Tower Width:

New York Avenues: 85'

New York Central Park: 50'

Chicago: 60'

San Francisco Franklin St: 50'



[illegible]

The form of high-rise buildings is also very important to consider, especially when the orientation of high-rises to low-rise buildings produces less than ideal solar conditions. While locating tall buildings north of low buildings is ideal, there are many situations where tall buildings exist east, west, or even south of low-rise buildings, which can produce very poor daylighting conditions. Controlling building width and spacing between towers will help these solar conditions and ensure that light and air can reach low lying buildings. Within the case studies, tower spacing ranges from 0' to 100'. This spacing has a correlation with the height of towers and the context and scale of the surroundings. In New York, the spacing between individual towers is minimal, but small blocks provide additional spacing to bring light to the interior of each block. In Chicago, the towers are taller, but have greater spacing, allowing light to enter and views toward Lake Michigan.

When the narrow edge or width of high-rise buildings faces low-rise buildings, it maximizes the solar exposure and viewsheds of the more low lying adjacent properties. Combining the orientation with wide spacing between buildings, and narrow widths of towers can help to create better urban conditions surrounding juxtapositions of high-rises and row-rise buildings.

RELATIONSHIP TO REGULATIONS

Empirical evidence can be used to resolve problems inherent with juxtapositions of high intensity development and low-rise neighborhoods through the application of dimensional analysis to the formation of regulations. The case studies illustrate ranges of dimensions that mitigate the issues with juxtapositions of high-rise buildings and low-rise buildings. Once these dimensions are embedded within regulations, development can perform similarly to the case studies and produce good urban conditions. Many regulatory strategies have been utilized through the past, and the empirical evidence of the case studies supports some of these regulatory strategies while opposing others.

New York Zoning Resolution of 1916

The New York Zoning Resolution of 1916 produced several of the situations highlighted within the case studies. Although the urban form of New York is the major informant of how the city has developed over time, the 1916 Zoning Ordinance worked with the subdivision to produce a fine grained urbanism that can accommodate a wide range of building scales. The ordinance reduced the width of taller towers, while the 100'x50' dimensions of lots helped prevent large scale high-rises in most cases.

Height Maps and Height Controls

The dimensional analysis of the case studies illustrates that height controls do not have a great effect at mitigating issues of juxtaposition of densities, as they focus on larger issues, such as views. Building height varied greatly both across all of the case studies and within each case study. Control of building form has a greater effect on the urban conditions of a site more than solely controlling height. While height controls can help prevent skyscrapers and buildings totally out of character of a neighborhood, they should not be relied upon to address the issues of high-rises in close proximity to low-rise buildings.

Setbacks

The empirical evidence also supports the use of setbacks, but only in certain applications and forms. Setbacks for the bulk of towers produce more slender, thin towers and can help provide spacing in between towers. Setbacks do not need to be utilized at ground level for the base of the building, but are more important for high-rise towers. In most cases, side setbacks of towers, not rear or front setbacks, help to produce better conditions for adjacent low-level buildings.

Transitional Height Planes

Although only one transitional height plane exists within the case studies, the case studies illustrate that they are not needed to address the challenges within juxtapositions of high intensity development and low-rise buildings. Transitional height planes focus on the wrong characteristics of building form and scale, and they can produce wide high-rises that prevent space for light and air to flow to adjacent buildings. Instead of transitional height planes, regulations should focus on dimensioning the spacing and widths of towers.

Brookwood Alliance Plan

The empirical evidence supports the ideas within the Brookwood Alliance Plan to utilize narrow towers and greater spacing between buildings. The proposed regulations can utilize dimensions of tower widths and tower spacings in order to bring real life analysis and application to them. The "Single Family Protection Zone" prevents the construction of tall buildings within a certain distance of residential zones. While this idea can work, several case studies exist where tall towers directly abut single family homes. Controlling the form of the towers instead of relying on a system of zones can improve the urban conditions of site in regards to juxtapositions. The "Single Family Protection Zone" can be rewritten to allow tall buildings but regulate building bulk through width and spacing of towers.

Relation to the Street

The relationship to the street is another important urban condition studied within the case studies. Tall building height to street width ratios varied a great amount between the case studies, illustrating that a wide range of building height to street width ratios are necessary to produce a finer grained urbanism. Regulations within LEED-ND specify that 15% of a block face should have a minimum height that is one third of the width of the street. In certain cases, the LEED-ND regulations can include additional ranges of height to street width ratios to create variation in scale and building.

Solar Orientation

The case studies show that the orientation and use of narrow buildings is very important to ensure good solar conditions for adjacent properties. This is in direct opposition to Walter Gropius' concept which relied upon wide buildings spaced out and oriented south to allow solar exposure for each building. Gropius' concept creates poor solar conditions in the spaces between each building and fails to fit in within existing urban forms. Instead solar orientation should be considered through the massing of each building, using the dimensions of case studies and real life examples to inform the spacing and massing of buildings.

Topography

In relation to topography, the case studies show the importance of the massing, spacing, and elevation of buildings. Similar to other regulatory strategies, controlling the massing, form, and spacing of buildings is significant to mitigating issues within juxtapositions of density. Tall towers can be spaced far from low buildings to accommodate changes of topography within blocks. Tall buildings can also be located at the tops of hills, such as in the case studies in San Francisco, supporting the ideas of the San Francisco Urban Design Plan of 1971. Taller buildings at the tops of hills act as an extension of the height of the hill, providing views, and operating in a way that does not block views from properties at lower elevations.

Conclusion / Recommendation to Cities

Since subdivision and urban form is the most permanent part of the city and the most difficult to change, modifications of regulations present the most realistic method to address the issues of juxtapositions of high intensity development and low-rise buildings. These regulations should recommend formal changes to development that mimic conditions produced through good urban form.

To address the issues of juxtapositions of density, cities should consider several regulatory strategies including: limiting tower width and increasing tower spacing, regulating the orientation of building mass and form, forming regulations that relate building height to street width, and the creation of built-in flexibility within the regulations. This research reveals several key dimensions from the analysis of the case studies that affect juxtapositions of densities, illustrated in the previous sections through diagrams. However, applying these dimensions broadly will not work, and a more case by case approach is needed.

While the case studies presented in this research provide a good basis for understanding these dimensions, greater analysis and research is needed to formulate exact numbers that can be implemented into existing development regulations. Cities should conduct research and analysis of the existing conditions and urban form within their city as well as case studies and best practices outside the city. Through this research, cities will attain empirical evidence, based off places that are proven to work, that can be used to formulate specific dimensions and characteristics for their regulations. With dimensions originating from empirical evidence of good urban conditions, regulations can help to form a more textured urbanism that mitigates the issues inherent in juxtapositions of density.

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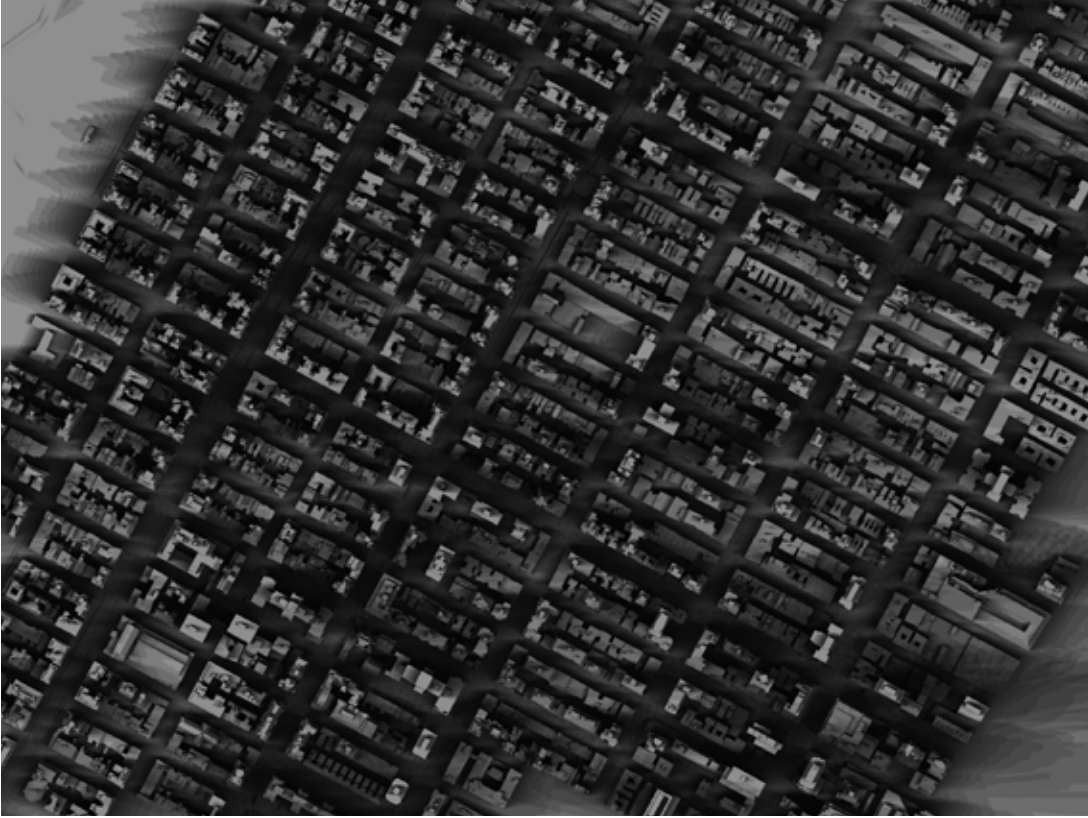
APPENDIX

Case Studies: Dimensional Matrix

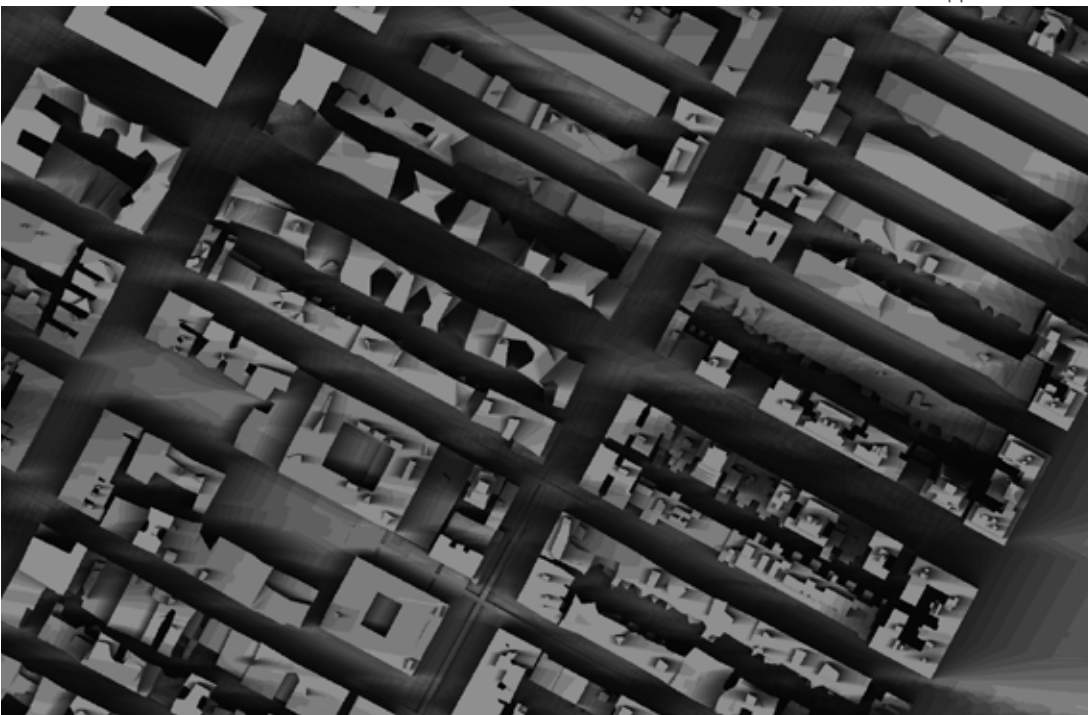
	WITHIN BLOCK					
Dimensional Qualities	NY:A	NY:86th	NY:UWS	CHI:Up	PHL:Rit	ATL:Brk
Subdivision						
Facing Lot Direction	90	180	90	90	180	90
Facing Greenspace	N	N	Y	n	Y	N
Dimensions Plan						
<i>Low Rise Building Lot Dimensions</i>						
Lot Depth	100	100	100	75	105	320
Lot Width	50	17	50	220	18	75
Lot Area	5000	1700	5000	16500	1890	24000
<i>High Rise Building Lot Dimensions</i>						
Lot Depth	125	100	125	225	100	320
Lot Width	100	80	80	245	100	315
Lot Area	12500	8000	10000	55125	10000	100800
Block Size	200X420-600	200X800	200X800	330X1068	230x392	1080X1125
RoW Width	55 street, 75-125 ave	82	50	60	25 alley	80
Dimensions Section						
<i>Low Rise Building Section Dimensions</i>						
Short Building Height	60	55	62	40	50	30
Short Building Depth	88	71	65	90	92	75
Short Building Width	50	17	50	40	18	30
<i>High Rise Building Section Dimensions</i>						
Tall Building Height	230	164	400	350	190	290
Tall Building Depth (Base)	120	85	130	135	100	260
Tall Building Width (Base)	85	80	200	225	42	280
Tall Building Depth (Tower)	120	85	70	200	100	270
Tall Building Width (Tower)	85	40	50	60	42	220
Building Height Difference	170	109	338	310	140	260
Building Height Ratio	3.83	2.98	6.45	8.75	3.80	9.67
Tall Building Height/Street Width Ratio	1.84	1.64	8.00	5.83	7.60	3.63
Transition Height Angle	0	0	60	0	0	0
Tall Building Depth/Lot Depth	0.96	0.85	0.56	0.89	1.00	0.84
Short Building Depth/Lot Depth	0.88	0.71	0.65	1.20	0.88	0.23
Tall Building Width/Lot Width	0.85	0.50	0.63	0.24	0.42	0.70
Short Building Width/Lot Width	1.00	1.00	1.00	0.18	1.00	0.40
Tall Building Tower Area/Base Area %	0.82	0.43	0.35	0.22	0.42	0.59
Space Between Buildings	25	34	10	20	37	50
Orientation						
Orientation of Tower to Low Building	E/W	N/S	E	E	N	E
Average Shadow Hours for Low Building	0-6	0-3	0-6	0-6	0-1	7
Topography						
Difference in Elevation	0	0	0	0	0	3
Angle of Average Slope	0	0	0	0	0	1%
Direction of Slope from Low Building	0	0	0	0	0	-

BLOCK TO BLOCK				TOPOGRAPHY				
NY:UWS	CHI:StSt	PHL:Rit	HOU:Gal	SEA:Vine	SF:Lag	SF:Frank	ATL:16th	LA:Wilsh
0	0	90	180	180	90	180	180	0
n	N	n	N	N	n	n	N	N
100	100	40	100	250	120	110	300	135
17	25	22	190	175	85	25	75	60
1700	2500	880	19000	43750	10200	2750	22500	8100
100	144	95	390	250	140	140	340	150
50	250	250	525	175	130	140	200	335
5000	36000	23750	204750	43750	18200	19600	68000	50250
200x450	225X1130, 330x540	400X240, 230X130	600x1500, 650x900	250x360	410x225	410x225	710x650	290X950
55	100	30	80	100	70	70	80, 12 alley	170
55	40	40	30	40	60	30	35	30
17	60	40	35	52	95	75	80	65
60	20	22	115	40	75	25	45	50
170	205	270	560	135	130	135	270	160
155	65	150	170	60	115	120	290	70
105	225	60	300	165	120	50	200	300
155	65	150	170	60	115	90	155	70
105	225	60	300	165	120	50	100	300
115	165	230	530	95	70	105	235	130
3.09	5.13	6.75	18.67	3.38	2.17	4.50	7.71	5.33
3.09	2.05	9.00	7.00	1.35	1.86	1.93	3.38	2.00
0	0	0	0	0	0	0	43	0
1.55	0.45	1.58	0.44	0.24	0.82	0.64	0.46	0.47
0.17	0.60	1.00	0.35	0.21	0.79	0.68	0.27	0.48
2.10	0.90	0.24	0.57	0.94	0.92	0.36	0.50	0.90
3.53	0.80	1.00	0.61	0.23	0.88	1.00	0.60	0.83
3.26	0.41	0.38	0.25	0.23	0.76	0.23	0.23	0.42
68	150	40	190	18	35	70	185	105
N/S	E	N	S	NE	N/S	S	SW	SE
5	0-3	0-1	6	0-2	0-1.	0-1	0-1	6
3	0	0	0	-11	-27	14	-23	22
4.50%	0	0	0	19%	19%	14%	14%	12%
-/+	0	0	0	+	+	-	+	-

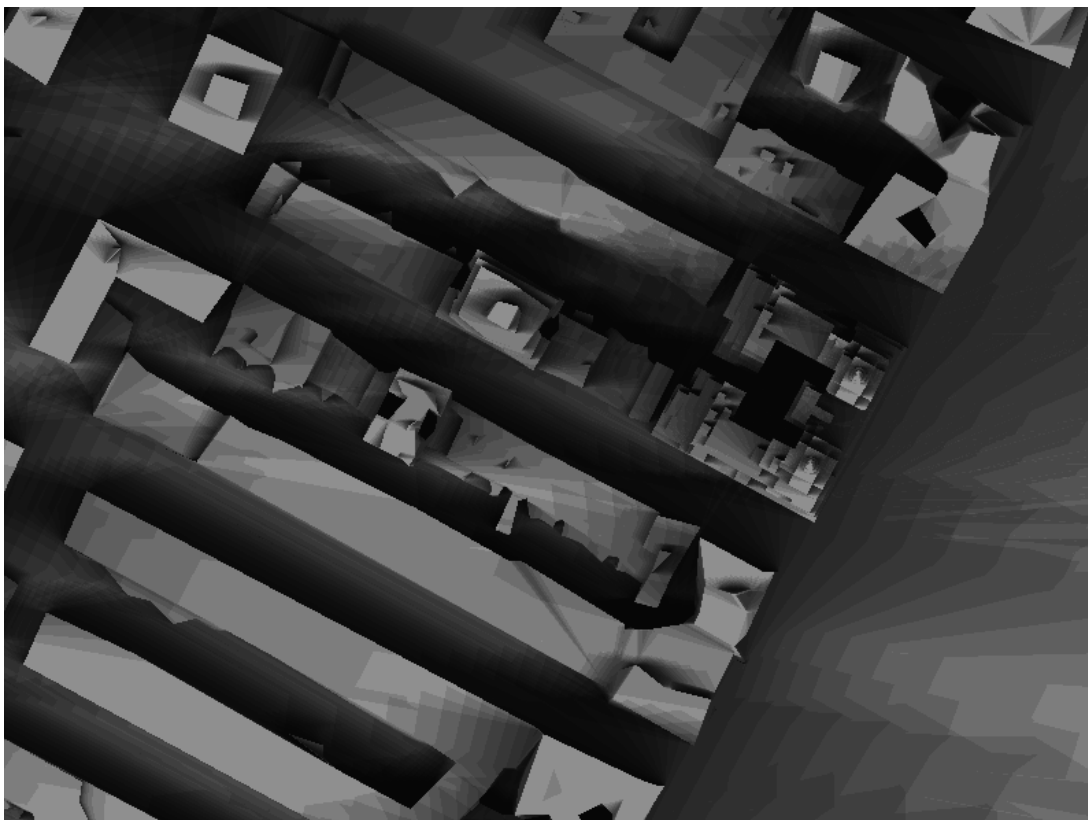
Case Studies: Shadow Range



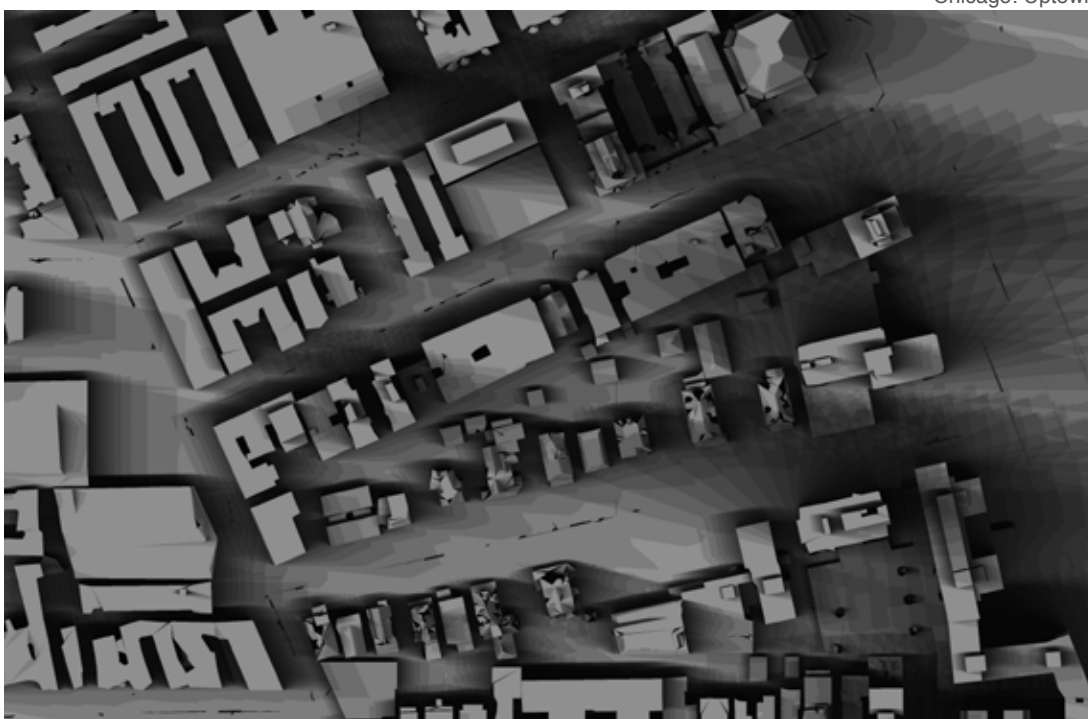
New York: Avenues on Upper East Side



New York: 86th Street on Upper West Side



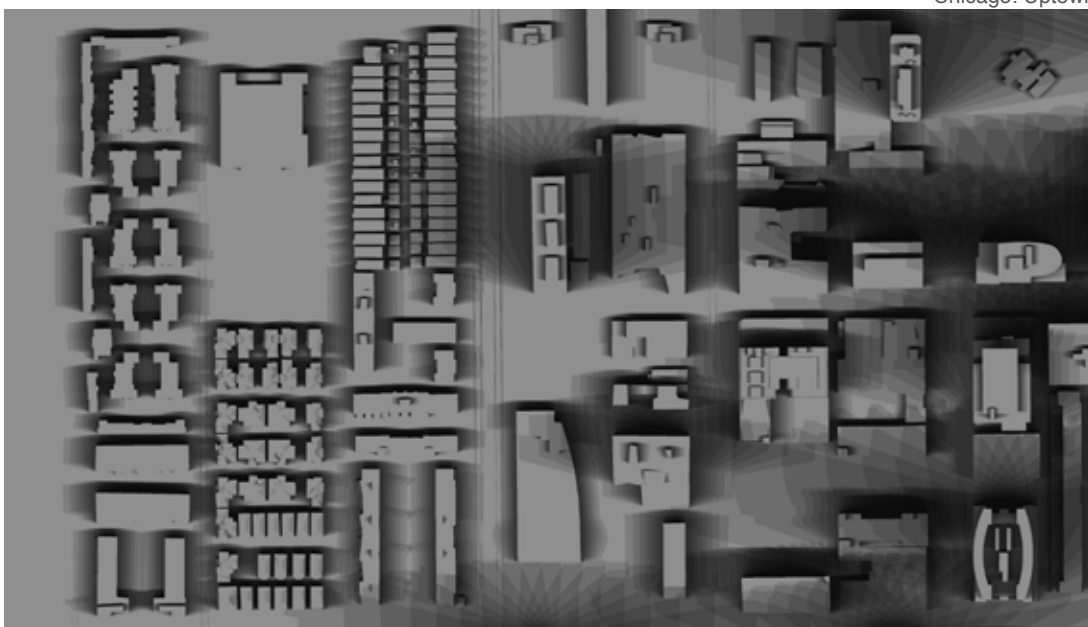
New York: Upper West Side and Central Park



Chicago: Uptown



Philadelphia: Rittenhouse Square



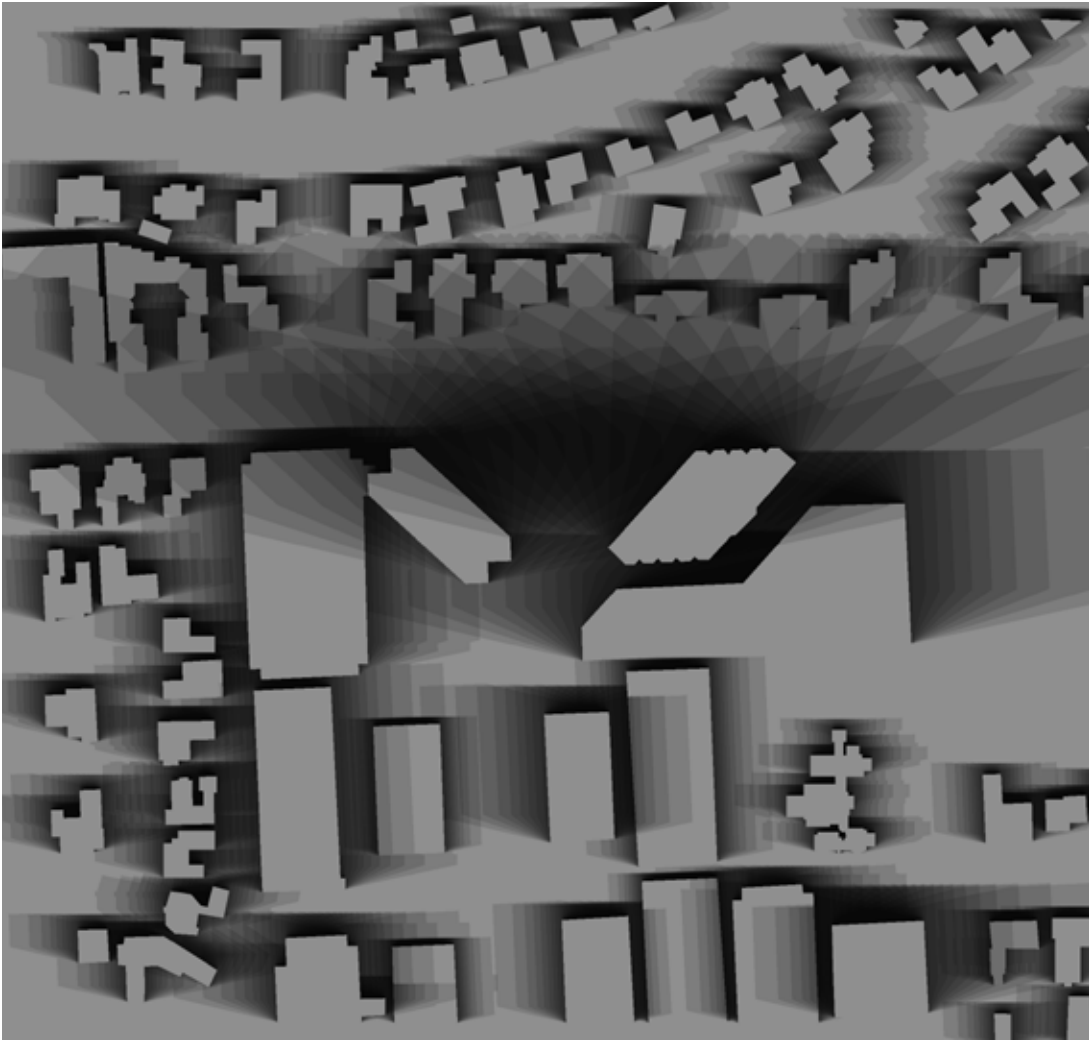
Chicago: Uptown



Philadelphia: Rittenhouse Square



Atlanta: Brookwood



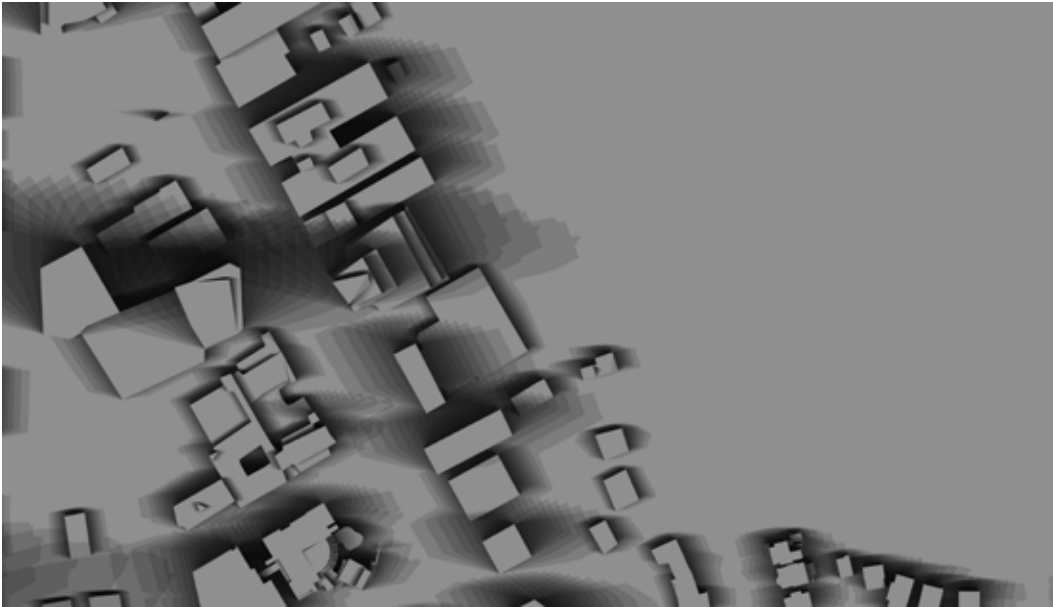
Houston: Galleria



Seattle: Vine Street



San Francisco: Gough and Franklin Streets



Atlanta: 16th Street and Ansley Park



Los Angeles: Wilshire Boulevard